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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
30 October 2003 (30.10.2003)

PCT

(10) International Publication Number
WO 03/088830 A1

(51) International Patent Classification[7]: A61B 5/00

(21) International Application Number: PCT/US03/11809

(22) International Filing Date: 15 April 2003 (15.04.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/372,894 16 April 2002 (16.04.2002) US

(63) Related by continuation (CON) or continuation-in-part (CIP) to earlier application:
US 60/372,894 (CON)
Filed on 16 April 2002 (16.04.2002)

(71) Applicant *(for all designated States except US)*: **CARE-MATIX, INC.** [US/US]; 2 North LaSalle Street, #1904, Chicago, IL 60602 (US).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: **KHANUJA, Sukhwant, Singh** [IN/IN]; 2300 Commonwealth, #7B, Chicago, IL 60614 (US). **GARG, Sandeep** [IN/IN]; 2528 Fairbanks Court, Naperville, IL 60540 (US). **SINGH, Irwin, Preet** [US/US]; 108 Eleanor Drive, Prospect Heights, IL 60070 (US).

(74) Agents: **PANIAGUAS, John, s.** et al.; Katten Muchin Zavis Rosenman, 525 West Monroe Street, #1600, Chicago, IL 60661-3693 (US).

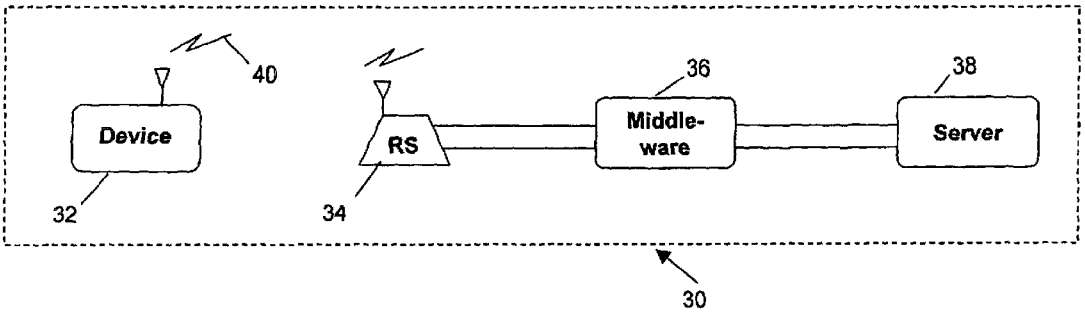
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PH, PL,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

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

Published:
— *with international search report*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

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.

(54) Title: METHOD AND APPARATUS FOR REMOTELY MONITORING THE CONDITION OF A PATIENT



(57) Abstract: The present invention relates to a patient monitoring system (30) which provides enhanced functional capability relative to known systems and provides a wireless communication link between a patient monitoring device (32), worn by a patient, and a local hub (34). The patient monitoring system (30) in accordance with the present invention is adapted to monitor various patient physiological characteristics, such as blood pressure, pulse rate, blood glucose, weight, pulse oximetry and others. The data from the patient monitoring device (32) is wirelessly transmitted to a local hub (34), which, in turn, is configured to automatically transfer the data to a remote server (38), for example, over a public or private communications network. The server can be configured as a web portal to selectively allow access to such patient physiological data by designated third parties, such as physicians, clinicians, relatives and the patient themselves. The system can provide enhanced functionality relative to known systems, and allows alarms and trends of the physiological data to be selectively generated.

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Method and Apparatus for Remotely Monitoring the Condition of a Patient

Background of the Invention

Computer Listing Appendix

[0001] This application includes a Computer Listing Appendix on compact disc, hereby incorporated by reference.

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims the benefit and priority of U.S. provisional patent application number 60/372,894, filed on April 16, 2002.

1. Field of the Invention

[0002] The present invention relates to a patient monitoring system and more particularly to a patient monitoring system for monitoring various physiological characteristic data of a patient, such as blood pressure, pulse rate, blood glucose, weight and others, which wirelessly transmits such data to a hub, located near the patient, which, in turn transfers the data automatically to a remote server, for example, over a public or private communications network, which, in one embodiment, the remote server is configured as a web portal which selectively allows access to patient data by selected third party users, such as physicians, clinicians, patients, and/or relatives, and, in addition provides increased functionality relative to known systems by enabling trends of the patient data to be developed as well as automatically generate communications with the patient or other third parties by way of e-mail or pager when predetermined thresholds for selected physiological characteristics are exceeded and/or to remind the patient to take physiological measurements.

2. Description of the Prior Art

[0003] Healthcare costs have been increasing at a tremendous rate for the past decade, far exceeding the rate of inflation. The compound average growth rate for healthcare spending over the past decade was 6%, amounting to nearly $1.3 trillion in the year 2001. Chronic disease patients, whose numbers have doubled during the same decade, account for nearly $700 billion of this spending. Managed care organizations have begun to seek help from disease management companies to contain the spending on chronic diseases. Disease management companies thus have developed systems to monitor the chronically ill patients

and help lower healthcare spending by improving patient compliance to medication schedules thereby lowering the hospitalization rates.

[0004] Various types of patient monitoring systems are known. For example, U.S. Patent Nos. 5,810,747 and 5,694,940 disclose patient monitoring systems in which the patient monitoring devices are hard wired to a local hub, which, in turn, is connected to a remote station, for example, over a communication network. The fact that the patient monitors are hard wired to the local station significantly reduces the utility of such systems. For example, such systems are obviously not suitable for ambulatory patients and many applications where it may be desired to remotely monitor the physiological characteristics of a patient outside of a non-clinical environment.

[0005] Accordingly, various systems have been developed in which the patient monitoring device, normally worn by a patient, is connected by way of a wireless link to a local hub, which, in turn, is connected to a remote station or server by way of a public communication network, such as the plain old telephone system (POTS). Examples of such systems are disclosed in U.S. Patent Nos. 3,882,277; 5,522,396; and 6,093,146. Each of these systems include a patient monitoring device, connected to a local hub by way of a wireless link, which, in turn, is connected to a remote server by way of a public communication link, such as POTS. Such systems depend on the use of telephone modems which require patients to place a phone receiver into a modem cradle and dial up the remote server. Such systems have been found to be far too complicated and difficult for elderly and critically ill patients.

[0006] In order to resolve this problem, patient monitoring systems, for example, as disclosed in U.S. Patent No. 6,336,900, have been developed, which not only provide a wireless link between the patient monitor and the local hub, but also automatically dial and connect to the remote server to facilitate the transfer of the physiological data to the remote server. Unfortunately, the functional capability of such systems is relatively limited. For example, such systems only provide limited access to the patient data. In addition, such systems can not be used to provide reminders to patients to take readings or provide messages to the patients or third parties when the physiological characteristics of a patient exceed predetermined thresholds. Thus, there is a need for a patient monitoring system for monitoring the physiological characteristics of a patient that provides enhanced functionality and expanded access to the healthcare data while not tethering the patient to a local hub, thereby improving patient compliance, affording the healthcare provider the ability to capture adverse events sooner and avoid costly emergency care and reduce costly home health visits.

Summary of the Invention

[0007] Briefly, the present invention relates to a patient monitoring system which provides enhanced functional capability relative to known systems and provides a wireless communication link between a patient monitoring device, worn by a patient, and a local hub. The patient monitoring system in accordance with the present invention is adapted to monitor various patient physiological characteristics, such as blood pressure, pulse rate, blood glucose, weight, pulse oximetry and others. The data from the patient monitoring device is wirelessly transmitted to a local hub, which, in turn, is configured to automatically transfer the data to a remote server, for example, over a public or private communications network. In one embodiment of the invention, the server is configured as a web portal to selectively allow access to such patient physiological data by designated third parties, such as physicians, clinicians, relatives and the patient themselves. In accordance with another important aspect of the invention, the system provides for enhanced functionality relative to known systems and allows trends of the physiological data to be selectively generated. In addition, any third party can set thresholds to automatically notify the patient or other third parties by various communication methods including e-mail and/or pager when a particular physiological characteristic exceeds a predetermined threshold. The system is also configured to provide reminders to patients to take readings.

Description of the Drawings

[0008] These and other advantages of the present invention will be readily understood from the following specification and attached drawing wherein:

[0009] FIG. 1 is a block diagram of the patient monitoring system in accordance with the present invention.

[0010] FIG. 2 is a block diagram of an alternate embodiment of the invention, illustrated in FIG. 1, illustrating the use of the invention in a multi-user, multi-hub environment.

[0011] FIG. 3 is a block diagram of an alternate embodiment of the invention, illustrated in FIG. 1, for a multi-user environment, single hub environment.

[0012] FIG. 4 is a block diagram of another alternate embodiment of the invention illustrated in FIG. 1 for a multi-user, single hub environment.

[0013] FIG. 5 is a block diagram of an exemplary physiological transducer for relatively complex transducers such as an electrocardiograph for use with the present invention.

[0014] FIG. 6 is a block diagram of exemplary self contained hub or base station for use with the present invention.

[0015] FIG. 7 is an exemplary schematic diagram of a relatively simple physiological transducer such as a blood pressure monitor, for use with the present invention.

[0016] FIG. 8 is an exemplary schematic diagram of an alternative hub or base station that is adopted to be connected to a middleware device, for use with the present invention.

[0017] FIG. 9A is a schematic diagram of the hub illustrated in FIG. 6.

[0018] FIG. 9B is a schematic diagram of the transceiver incorporated into the hub illustrated in FIG. 9A.

[0019] FIG. 10 is a schematic diagram of the exemplary physiological transducer illustrated in FIG. 7.

[0020] FIG. 11 is an exemplary block diagram of the server application architecture in accordance the present invention.

[0021] FIG. 12 is a diagram illustrating an exemplary message exchange between a patient monitoring device and a hub for the system in accordance with the present invention.

[0022] FIG. 13 is an exemplary software flow diagram for synchronizing the patient monitoring device to a hub in accordance with the present invention.

[0023] FIGS. 14 and 15 are exemplary flow diagrams illustrating the hub to web server synchronization.

[0024] FIG. 16 is an exemplary flow diagram illustrating the data server/portal to user interaction in accordance with the present invention.

[0025] FIGS. 17-24 are exemplary screen shots for use with a web-based embodiment of the present invention.

Detailed Description

[0026] The present invention relates to a patient monitoring system for monitoring various physiological characteristics of a patient, such as blood pressure, pulse rate and others, as discussed below. The system includes a portable physiological transducer or patient monitoring device that can be worn by a patient in both single user and multi-user applications. The patient monitoring device is adapted to monitor physiological characteristic data of the patient and wirelessly transmit the data to a local hub or base station. In order to

reduce the complexity of the system, the hub or base station is configured to automatically transfer the data to a remote server by way of a public or private communication network. In accordance with an important aspect of the invention, the system is configured to selectively enable access to a patients' physiological data by various selectable third party users, as well as the patient. In accordance with another aspect of the present invention, the patient monitoring system provides enhanced functionality relative to known systems. For example, the system in accordance with the present invention enables selectable third party users, as well as the patient, to monitor trends in the data for the physiological characteristics, as well as set alarms, which can automatically generate communications with the patient and/or third parties when a physiological characteristic exceeds a predetermined value. These communications can be, for example, by e-mail or pager. In one embodiment of the invention, a bi-directional communication link is provided between the patient monitoring device and the local hub. This bi-directional communication link allows communications to be sent to the patient monitoring device, for example, to remind a patient to take a physiological reading. The bi-directional communication link also allows handshaking between the patient monitoring device and the local hub to insure the transfer of physiological data to the local hub.

[0027] As will be discussed in more detail below, the system in accordance with the present invention can be utilized in a wide variety of applications. For example, FIG. 1 illustrates a single user/single hub application. FIG. 2 illustrates a multiple user/multiple hub application. FIGS. 3 and 4 illustrate a multiple user/single hub environment, for example, a cardiac rehabilitation facility in which each of the patients wear a portable heart monitor during cardiac rehabilitation.

[0028] FIGS. 5-10 illustrate exemplary hardware diagrams for the portable physiological transducer and the hub for use with the present invention. In particular, FIG. 5 illustrates an exemplary block diagram of a portable physiological transducer for relatively complex transducers, such as a electrocardiograph. FIG. 7 illustrates an exemplary block diagram of a relatively simple portable physiological transducer, for example, a blood pressure transducer. Both transducers illustrated in FIGS. 5 and 7 may include an audio or visual indicating device to enable reminder messages to be sent to the patient monitoring device. FIG. 6 illustrates a block diagram of a exemplary self contained hub or base station for use with the present invention. FIG. 8 illustrates a block diagram of an exemplary hub that is adapted to be connected to a middleware device. FIG. 9A is a schematic diagram of a self contained hub

illustrated in FIG. 6. FIG. 9B is a schematic diagram of the transceiver incorporated into the hub, illustrated in FIG. 9A. FIG. 10 illustrates an exemplary schematic diagram for a relatively simple patient monitoring device, such as a blood pressure monitor.

[0029] FIGS. 11-16 relate to the software. FIG. 11 is a block diagram of the server application architecture. FIG. 12 is an exemplary block diagram illustrating an exemplary message exchange between a portable physiological transducer or patient monitoring device and the self contained hub in accordance with the present invention. FIG. 13 is an exemplary software flow diagram illustrating the synchronization of the patient monitoring device with the hub in accordance with the present invention. FIGS. 14 and 15 illustrate the synchronization of the hub to the web server. FIG. 16 illustrates an exemplary flow diagram illustrating the data server to user interaction in accordance with the present invention.

[0030] In one exemplary embodiment of the invention, the system is configured as a web portal. In this embodiment, the server is configured as a web server and selectively allows third party access as well as access by the patient to the physiological data transmitted by the portable patient monitoring device. In addition, the system can be used to provide aural and/or visual signals to the patient monitoring device to remind a patient to take readings. As discussed above and as will be discussed in more detail below, various third parties, such as the physician and/or relatives, as well as the patient, can not only access the physiological data of the patient but also view trends of such data and also set alarms which automatically generate messages to either the patient and/or other third parties when the physiological characteristics of the patient exceed a preset value. In accordance with this embodiment, various screen shots as illustrated in FIGS. 17-23 are provided.

System

[0031] FIGS. 1-4 illustrate various system applications for the patient monitoring system in accordance with the present invention. In particular, single user/single hub applications, as well as multiple user/single hub and multiple user/multiple hub applications are within the broad scope of the present invention. As such, the patient monitoring system in accordance with the present invention can be used in a relatively wide variety of applications from non-clinical applications, such as a home healthcare and health club applications, as well as various clinical applications.

[0032] Referring first to FIG. 1, an embodiment of a patient monitoring system is illustrated and generally identified with the reference numeral 30. The patient monitoring system 30

illustrates a single user/single hub application, for example, a home healthcare application. In this application, the patient monitoring system 30 includes a portable physiological monitor or patient monitoring device, identified with the reference numeral 32, a local hub 34, a middleware device 36, which may or may not be incorporated into the hub 34, as well as a remote server 38. The patient monitoring device 32 can be one of multiple portable physiological transducer, such as a blood pressure monitor, heart rate monitor, weight scale, thermometer, spirometer, single or multiple lead electrocardiograph (ECG), a pulse oxymeter, a body fat monitor, a cholesterol monitor or a signal from an exercise machine, such as a heart rate. As will be discussed in more detail below, the patient monitoring device 32 is a portable device worn by the patient and includes a single or bi-directional wireless communication link, generally identified with the reference numeral 40, for transmitting data from the patient monitoring device 32 to the local hub or receiving station 34 by way of a wireless radio frequency (RF) link using a proprietary or non-proprietary protocol.

[0033] In this embodiment of the invention, the system includes a local hub or receiving station 34 which wirelessly receives data from the patient monitoring device 32 and automatically communicates it to a middleware device 36, which may be a personal computer, an Internet gateway, a home gateway, a phone, a video phone, or a phone modem. Alternatively, the middleware device 36 may not be required if the hub 34 includes its own processing equipment, as will be discussed below. In particular, the middleware device 36 may form part of the hub 34.

[0034] The hub or receiving station 34 may be a receiver or transceiver for receiving data from the patient monitoring device 32. Communication, if required, between the hub 34 and the middleware device 36, may be over various communication links, such as a direct connection, such a serial connection, USB connection, Firewire connection or may be optically based, such as infrared or wireless based, for example, home RF, IEEE standard 802.11a/b, Bluetooth or the like.

[0035] The middleware device 36 transfers the data received by the hub or receiving station 34 to a remote server 38. The communication link between the middleware device 36 and the remote server may be by direct connection, such as a serial connection, USB, Firewire or optically based such as infrared or wireless based such as home RF, IEEE standard 802.11b, Bluetooth or others. For longer distances, a communication link between the middleware device 36 and a remote server 38 may be by DSL, T-1 connection over a private communication network or a public information network, such as the Internet.

[0036] In accordance with one aspect of the invention, the remote server 38 may be configured to provide third party access to the patient physiological data forming a portal. The portal, for example, a web portal, allows the patient and/or third party users, such as relatives and physicians, to interact with the patient data in various ways as discussed below.

[0037] FIG. 2 illustrates a multi-user/multi-hub application of the present invention, generally identified with the reference numeral 42. In this embodiment, three (3) exemplary patient monitoring devices 44, 46 and 48 are used to transmit data to multiple hubs 50 and 52. The hubs 50 and 52 transfer the data to middleware devices 54 and 56, which, as discussed above may be a personal computer (PC) 54 or a phone line, web phone or video phone 56 or may be integrated into the hubs 50 and 52. In this embodiment, the middleware devices 54 and 56, in turn, transmit the data to a remote server 58. In accordance with an important aspect of the invention, various third parties, such as a physician or relatives, can selectively access the patient physiological data in the server 58, as indicated by the function block 60.

[0038] FIGS. 3 and 4 illustrate a multi-user/single hub application, for use in multiple user applications, such as a retirement home. Two embodiments of this application are contemplated as illustrated in FIGS. 3 and 4. Referring first to FIG. 3, the patient monitoring system is generally identified with the reference numeral 62. The patient monitoring system 62 includes a patient monitoring device 64, a hub 66, an ID reader 68, a middleware device 70 and a remote server 72. The patient monitoring device 64, hub 66, middleware device 70 and the server 72, as well as the communication links therebetween, are as described above. In the exemplary application illustrated in FIG. 3, the ID reader 68 is operatively connected to the hub 66 to accommodate different users in a multiple user environment. In such an application, each user is given a unique ID. This ID is input into the hub 66. Various types of identification are contemplated. For example, the ID reader 68 may be a swipe card, RF tag or push button. In this embodiment, the user ID is read from the ID tag of the user at the same time physiological data is being read from the patient monitoring device 64.

[0039] FIG. 4 illustrates an alternative embodiment of the invention illustrated in FIG. 3. This embodiment is generally identified with the reference numeral 74. The patient monitoring system 74 includes a patient monitoring device 76, a hub 78, a server 82 and an ID reader 84. The patient monitoring system 74 is similar to the patient monitoring system 62, illustrated in FIG. 3, except that the patient monitoring system 74 is configured such that the ID reader 84 is coupled to the patient monitoring device 76. In this embodiment, the user ID and physiological data is transmitted together to the hub 78. In lieu of the ID reader, the

patient monitoring device 76 can be configured such that the device transmits an unique ID with the physiological data. Thus, different users wearing different devices can easily be correlated by the system.

Hardware

[0040] The hardware for the patient monitoring device, as well as the hub, is illustrated in FIGS. 5-10. As mentioned above, FIGS. 5 and 7 relate to a patient monitoring devices, generally identified with the reference numerals 84 and 85, for use with the present invention. FIGS. 6 and 8 illustrate exemplary hubs for use with the present invention. FIG. 10 is an exemplary schematic diagram of the patient monitoring device 84, illustrated in FIG. 5.

Exemplary Patient Monitoring Devices

[0041] Various embodiments of the patient monitoring devices 84 and 85 are contemplated. Both embodiments may optionally include a visual or audio indicating device to allow visual and/or audio communications to be sent from the system to the patient monitoring device. The patient monitoring device 85 (FIG. 7) is representative of patient monitoring devices which utilize relatively simple transducers, such as a blood pressure monitor, heart rate monitor and others. The patient monitoring device 85 includes a transducer 88, such as a blood pressure transducer, coupled to a communication module 90. The communication module 90 may include a microprocessor 92, a memory real time clock 94, as well as a transmitter for unidirectional communications or a transceiver 96 which enables bi-directional communication between the patient monitoring device 85 and a local hub, as discussed above. An audio or visual indicating device 93 may also be provided to enable alerts or messages to be sent to the patient monitoring device 85. The transducer 88 may be directly wired to the communication module 90, as indicated by the electrical leads 98. An antenna 100 is provided in order to provide a wireless link to the local hub, as discussed above. A power supply 102, such as a battery may be provided.

[0042] The MCU 92 may be, for example, Motorola model number 68HC908GP32. The radio 96 may be, for example, a Xemics model number XE 1201. The memory 94 may be, for example, an Atmelmodel number CAT 24AA65. The real time clock may be a Dallas Semiconductor model number DS 1675.

[0043] More sophisticated patient monitoring devices 84, as illustrated in FIG. 5, such as electrocardiograph (ECG) devices, may include one or more transducers which directly communicate with a microprocessor 106. An input/output (I/O) device 108 may be directly

coupled to the microprocessor 106, for example, for receiving data from electrodes attached to the patients' body by way of electrical leads (not shown). As is well known in the art, this data is received by the microprocessor 106 and configured by the transducer 104 and communicated to a communication module 110. The communication module 110 includes its own microprocessor 112, a memory 114 such as an electrically erasable programmable read only memory (EEPROM), a radio 114 for bi-directional communication or simply a transmitter for unidirectional communication, as well as an antenna 116.

[0044] Various physiological transducers can be integrated into the system. These transducers are similar to various commercially available transducers such as: a blood pressure transducer, such as A&D blood pressure cuff, model number UA-767PC; a weight scale, such as an A&D scale, model number UC-321; a blood glucose meter, such as a LifeScan ONE TOUCH® Ultra; a pulse oximeter, such as a PalmSat Model 2500; a spirometer, such as a Micro Direct model MICRO DL; a prothromben time test for Coumadin® therapy, such as a PT/NR Protime Microcoagulation System; and a cholesterol monitor, such as a LSP 3101 Personal Cholesterol Monitor Kit. Virtually any physiological transducer which generates an electrical signal can be implemented in the system.

Hub Hardware

[0045] Exemplary block diagrams for the hub for use with the present invention is illustrated in FIGS. 6 and 8. Referring first to FIG. 8, the hub 87 includes a radio 116, a microprocessor 118 and a memory/real time clock 120. The hub 87 also includes and an antenna 120 and a power supply 122 if required. This embodiment of the hub 87 is for an embodiment in which there is a separate communication link as discussed above to a middleware device 122 for embodiments in which the middleware device 122 is separated from the hub 87.

[0046] FIG. 6 illustrates an alternative embodiment of the hub, identified with the reference numeral 86 in which the middleware device is integrally formed with the hub. In this embodiment, the hub 86 includes a radio 126 and an antenna 128 for receiving data wirelessly from the patient monitoring device. The hub 86 also includes a microprocessor 130, a real time clock 132, a memory device such as a EEPROM 134 and a modem 136. The microprocessor 130, radio 126, real time clock 132 and memory 134 may be as discussed above. The modem may be a ConnectOne embedded iModem, Model Number iM336UC-EM.

[0047] FIG. 9A is an exemplary schematic diagram of the hub 86 illustrated in FIG. 6. FIG. 9B is an exemplary schematic diagram of the transceiver 126 illustrated in FIG. 9A.

Software

[0048] FIGS. 11-16 illustrate the system software. FIG. 11 illustrates the server application architecture. FIG. 12 illustrates the message exchange between a patient monitoring device and the hub. FIG. 13 illustrates the software for synchronizing data from the patient monitoring device to the hub. FIG. 14 illustrates the synchronization between the hub and the remote server and specifically relates to user registration. FIG. 15 illustrates the software flow diagram for interaction between the hub and the web server. FIG. 16 illustrates the software flow diagram for interaction between the user and data server/portal.

[0049] Referring first to FIGS. 13-16, FIG. 13 illustrates the software for controlling the patient monitoring device and transmitting the data from the patient monitoring device to the hub. Initially, in step 138, on power up, the patient monitoring device, either on its own or in response to patient input, begins taking readings of a patient physiological characteristic. These readings are stored in the patient monitoring device along with a time stamp and device ID in step 140. In step 142, the patient monitoring device sends out RF signals with its ID in an attempt to locate a local hub. If no hub responds as indicated in step 144, the patient monitoring device stores the data and goes to sleep in step 146. Subsequently, after a preset time, the device awakens in step 148 and returns to step 142 and attempts to locate a hub.

[0050] Once a hub is located, the hub responds with a handshake signal indicating that it is available to receive data as indicated in step 150. After the handshake, the hub may communicate various information to the patient monitoring device in step 152. For example, the hub may send a message to the patient monitoring device indicating that previous readings have been received. The hub may also send a message to the patient monitoring device with the current date and time to update that device. In addition, the hub may send reminders at specified dates and times to remind a patient when to take readings for those patient physiological devices which do not constantly take readings. Finally, the hub may also send a message to the patient monitoring device to change the frequency or baud rate of the communication. Subsequently, in step 154, the patient monitoring device synchronizes its date and time stamp and deletes all previous readings to the date and time in order to initialize the patient monitoring device. After the patient monitoring device is initialized in

step 154, the patient monitoring device then sends the data to the hub in step 156 with its associated ID and date and time. The patient monitoring device may also send data to the hub indicating that its battery is low. In step 158, the hub acknowledges receipt of each message received.

[0051] The message exchange between the patient monitoring device and the hub is illustrated diagrammatically in FIG. 12. Initially, as indicated in box 160, the patient monitoring device on power up sends a query to the hub, as indicated by the message 162. The hub in response to that query checks whether the ID number for the patient monitoring device is listed, as indicated by the block 164. In addition, the hub may also communicate its local date and time as well as control information with respect to clearing the log and frequency change, as message 164. This information is acknowledged and acted upon by the patient monitoring device, as indicated by the message 168. After the patient monitoring device is time synchronized with the hub, the patient monitoring device begins sending data to the hub along with its ID and time stamp, as indicated by the message 170.

[0052] The above message exchange may be identified as a pre-cycle message exchange. Such a pre-cycle message exchange is identified as a time period when the patient monitoring transducer is not actively recording data such as during a time period when a blood pressure cuff has not been inflated.

[0053] After the data has been transmitted from the patient monitoring device to the hub, post cycle messages include repeating the messages 162 and 166 after each data cycle has been completed. In addition, a message 172 may be sent from the patient monitoring device to the hub for the first piece of data, indicated by the box 174. After the hub receives the data 174, it sends a message back to the patient monitoring device indicating that the data 174 has been received. Once the patient monitoring device acknowledges from the hub that the first bit of data has been received, additional data is sent by way of a message 178 to the hub, as indicated by the data block 180. The hub responds that the data 180 was received by way of a message 182 back to the patient monitoring device. After all of the data has been transmitted from the patient monitoring device to the hub, the patient monitoring device sends a message 184 indicating that the next bit of data is the last bit of data in the memory to be sent by the patient monitoring device by way of the message 184. The hub then acknowledges receiving the last bit of data 186 by acknowledging by way of message 188 back to the patient monitoring device 188 that it has received that data 186.

[0054] FIGS. 14 and 15 illustrate the synchronization between the hub and the remote server. In accordance with an important aspect of the invention, the server in this embodiment is configured as a portal, for example, a web portal, which enables third party users to selectively access patient physiological data transferred to the remote server. In this application, users register on the portal and create an account in step 190. In step 192, the user registers one or more devices (i.e. device ID's) with their account. Next, in step 194, the list of registered devices for a particular user is synchronized with the hub thereby enabling the hub to receive data for the specified device IDs. In step 196, the hub filters wireless communications from various patient monitor devices and only responds to data originating from registered devices. In step 198, any updates of the registered devices with respect to a user's account are synchronized with the hub.

[0055] FIG. 15 illustrates a software diagram for transferring data between the hub and the remote server. Initially, in step 200, data is received by the hub as discussed above. In step 202, the data may be stored, for example, in XML format, for example, and optionally encrypted with readings with unsynchronized time stamps, which may be corrected to best estimates. In step 204, if the hub is not connected to the server, the server looks for an Internet connection or creates a connection over a LAN/phone line automatically and sends the data to the web server when connection is established. In step 206, data is uploaded to the web server and associated to a device ID and user. The web server responds in step 208 by sending messages to synchronize the data including a time and date stamp of last received data (clear log); a list of date and time stamps for reminders; and may include a down load list of device IDs associated with that hub.

[0056] FIG. 16 is a software flow diagram used to control the data server/portal in connection with user interaction. Initially, in step 210, data is received by the data server from the hub. In step 212, the data may be decrypted and staged for acceptance by the user after a user logs in. Subsequently, in step 214, the data is cataloged in a user data repository or database to enable the user to interact with the data in meaningful ways like display charts, tables and trigger alarms and trends. As indicated in step 216, the data may be checked against preset requirements for alerts and trends. These alerts and trends may be shown to the user in step 218 in various ways on a web page, a pager, a telephone, an e-mail to a selected list of people to be informed. The web server may then display the charts and tables in step 220. The reports and tables can be exported to spreadsheets and/or e-mailed to third parties in step 222

for review. In step 224, the server allows additional third party access for the various data in step 224.

[0057] As indicated in step 226, when connection, such as Internet connection, is established between the hub and the server, the server sends the hub various messages. These messages may include the current device ID list for the user to the hub. The messages may also include date and time stamps for reminders and the date/time stamp of the last updated reading.

Web Pages

[0058] In a exemplary embodiment, as discussed in detail below, the remote server may be configured as a web portal. Exemplary web pages for a patient monitoring system are illustrated in FIGS. 17-24. In particular, FIG. 17 illustrates exemplary home page generally identified with the reference numeral 228. This web page 228 includes a registration box 230 and an account box 232. The registration box 230 allows patients to register and unregister various physiological characteristic measurements. The account box 232 provides a summary of a patients' alert and trends. The account box 232 includes links 234 and 236 to screens where alerts and trends can be set.

[0059] FIG. 18 illustrates a exemplary web page 238 which allows a user, either a patient or a third party user, to track data by way of a display window 240. The exemplary web page 238 allows a user to track data, view it by device type, change the time scale as well as annotate the data. FIG. 19 is an exemplary web page which allows a user to view data in tabular form. On this page, the time range and device data can be selected by the user. FIG. 20 is an exemplary web page 244 which enables a user to set reminders for the device to provide reminders, either aurally or visually at certain times or at periodic intervals. FIG. 21 is an exemplary web page 246 which allows a user to set alert parameters on absolute values and to specify how to receive the alerts via browser, e-mail, voicemail, pager, etc. In particular, "My Account" boxes generally identified with the reference numeral 248, allow the particular message link to be selected. FIG. 22 illustrates an exemplary web page 250. The web page 250 allows a user to set up parameters, baselines and trends. FIG. 23 illustrates an exemplary web page 252 which may be used by a clinical administrator to monitor a summary status of all assigned patients including the last reading and any alerts generated. FIG. 24 illustrates an exemplary web page 254 for use by an administrator to view the devices registered by various users in the system.

Server Application Architecture

[0060] FIG. 11 illustrates the server application architecture. The server application architecture may include four levels or tiers 228, 230, 232, 234. The tier 228 may be a user or client tier which allows users to interact with the underlying application. This client tier translates user actions and inputs them as server requests and formats a server response, usually visual. The client tier may be a client, such as a browser, or a custom application running on a hub or specific devices such as wired, wireless handheld Personal Digital Assistants (PDAs). The client tier may also be a non-user action, such as automated services, such as Internet Explorer.

[0061] The web tier 230 makes application functionality available on the worldwide web. This tier 230 accesses data and business functionalities, manages screen flow and often encapsulates some user interaction. It may be used to decouple the client from the business logic tier 232 to provide a uniform service model of client request. The web tier interacts with other tiers using standard protocols. Other applications may take place of the client programs accessing the underlying application through its web tie, such as Apache/Tomcat.

[0062] The business logic tier 232 encapsulates the business logic and comprises the software application functionality. The logic is organized as a set of interacting objects allowing for additions and enhancement of the logic at any point while still preserving the interface of other tiers. This business logic tier 232 may be implemented using J2EE, Microsoft.NET or a custom architecture, such as Tomcat.

[0063] The data access tier 234 may be used to integrate the application with other enterprise information systems. This tier 234 provides data storage and other information services to the application. It may consist of a database, enterprise resource planning systems, mainframe transaction processors, legacy systems and enterprise integration technologies. Other tiers access these databases using industry standard or custom protocols such as Oracle.

Web Portal Details

[0064] As mentioned above, in one exemplary embodiment of the invention, a web portal (hereafter referred to as the portal) provides meaningful access to a patient's personal health data, as collected by the patient monitoring device(s) and stored in a server-based data repository (hereafter referred to as the repository). Some key mechanisms of the portal are listed below and are explained in further detail in subsequent sections. These key mechanisms include:

- A mechanism for self-registration of devices by the user.
- A mechanism to synchronize data between the Repository and device(s) via the Receiving Station.
- A mechanism to allow the user to preview the readings received from the device(s) and reject erroneous readings.
- A mechanism to generate alerts against received data, based on user defined parameters.
- A mechanism to determine trends in received data, based on user defined parameters.
- A mechanism to match computed trends with visual perception of the trend.
- A mechanism to set reminders on the device(s). This mechanism can be extended to set up any arbitrary "event" on the device(s) e.g. local alert generation.
- A mechanism by which a clinician may monitor a group or a number of users via a summary "dashboard" of their readings data, with ability to drill-down into details for each user.
- A mechanism to enhance user (healthcare) education by providing a healthcare questionnaire dynamically created (and updated) based upon certain rules applied to recent user readings data.
- A mechanism to provide data feeds (i.e. export, either "raw" or aggregated) to external systems with transformations between appropriate data formats.

Device Registration through Portal

[0065] Device registration is the process by which a patient monitoring device is associated with one or more users of the system. This mechanism is also used when provisioning devices for a user by a third party, such as a clinician (or their respective delegate). The mechanism is as follows:

1. The user (or delegate) identifies himself/herself by logging into the portal. The user must have previously registered an account created either by themselves or by delegates.

2. User (or delegate) registers a device by:

    a. Choosing from a list of kinds of devices available for registration.

b. Providing identification information for the device such as manufacturer information, device model information, device serial number (available on device packaging) and optionally a hub number (available on hub packaging). The user may register more than one device at this point.

c. Optionally setting up a service subscription for device(s) usage. This includes selecting service plans and providing payment information.

3. The device(s) are then associated with this user's account and a Device Control File (discussed below) comprised of device identification information is synchronized between the server and the Receiving Station on initialization (see the section Data Synchronization between Receiving Station and Repository). This enables the Receiving Station to respond to and accept input from the devices that have their identification information in the control file.

4. On each interaction between the hub and the server, the control file entries for the current user (or hub) are synchronized.

5. Similarly, whenever the user registers a device, its entry is added to the control file on the hub if not already there on the next synchronization interaction with the server.

6. No association information between the actual user (person) and the device is kept on the user's hub. This determination is made after the data is uploaded to the server.

7. The hub may be shared between users and data for all users resident on the hub is uploaded to the server on synchronization.

Device Control File

[0066] This file contains records in the format

<device id>, <data update timestamp>

where <device id> is all the information required to uniquely identify a device to the system (such as manufacturer number, model number, serial number and user number) and the <data update timestamp> is the timestamp (including date) that data for this device was last received by the server. Note that this is not the timestamp for which data was last uploaded from this particular hub (on which the control file resides) but is the timestamp for which the server last received data (from any hub) for the particular (registered) device. Additional information for controlling the device(s) e.g. reminder information is also maintained in this file.

This file is internally maintained in XML format for ease of interfacing but is either kept encrypted or in a non-readable format on the hub for security reasons.

User Data File

[0067] This file contains records in the format

<device id>, <reading timestamp>, <reading data>

where <device id> is as described in the section Device Control File. The <reading timestamp> is the time of the reading and the <reading data> is a data record in a format specific to the type of reading. This file is internally maintained in XML format for ease of interfacing but is kept encrypted or in a non-readable format on the hub for security reasons.

Data Synchronization between Receiving Station and Repository

[0068] The hub and the Repository frequently synchronize data. The hub may use one of various transportation methods to connect to the repository e.g. using a PC as conduit or via a connection established using an embedded modem (connected to a phone line) or via another network-connected device (such as, but not limited to, a web-phone, video-phone, embedded computer, PDA or handheld computer). The mechanism is as follows:

1. When a user logs into the portal, the User Data File, resident on the hub, is uploaded to server. The server filters duplicate readings records.

2. Alternatively, the Data Synchronization Client may upload the data from the hub to the Server without user intervention automatic data synchronization without user intervention also happens in the case of a stand-alone hub.

3. The data may be decrypted on the server, assigned to each user (by determining which user the device is registered with) and put into a staging area. This staging area is so that the user may optionally preview the data before accepting the values. The server also filters for duplicate reading values.

4. The device control file is uploaded to the server.

5. The server downloads updated device control file with last updated timestamps for each device in list. If device has been removed from the system, then its entry in the file is deleted. The old device list file is backed up.

6. The data file is cleared/deleted.

Data Synchronization Client

[0069] There is often the need for the reading data to be uploaded to the server without explicit user intervention. The Data Synchronization Client runs on the hub to upload the user's data to the server while synchronizing the information contained in the control file.

Alerts

[0070] Users may set up alerts that are triggered when one or more reading meet a certain set of conditions, depending on parameters defined by the user. The mechanism is as follows:

1. The user sets up an alert by choosing the condition that they would like to be alerted to and by providing the parameters (e.g. threshold value for the reading) for alert generation.

2. Each alert thus set up has an interval associated with it. This interval may be either the number of data points or a time duration in units such as hours, days, weeks or months, depending on the type of reading for which this alert is being set up.

3. The values of readings lying within the interval specified by the user must all either positively or negatively exceed the specified threshold for the alert to be generated i.e. there is an implied "and" across all the readings within the interval.

4. The user chooses the destination where the alert may be sent. This destination may include the user's portal, e-mail, pager, voice-mail or any combination of the above.

5. Specific, preset alerts are provided based on medically established conditions in the case of common reading types e.g. heart rate, weight, blood sugar etc. The user may modify the parameter values for these alerts if they so desire.

Trends

[0071] The system computes trends in the user's data values over an interval. The mechanism is as follows:

1. Trends are determined by applying mathematical and statistical rules (e.g. moving average and deviation) over a set of reading values. Each rule is configurable by parameters that are either automatically calculated or are set by the user.

2. Currently the system tracks deviations from baseline values (see section Baselines) either automatically calculated using intelligent defaults or provided by the user.

3. The user also supplies a range over which the trend is calculated. This is specified either as the number of data points or a numerical unit of time (e.g. hours, days, weeks etc, depending on reading type).

4. This range is always applied backwards from the most current reading i.e. if the user specifies that the trend needs to be calculated over the past 5 days, then the system will calculate the trend of the past 5 days from current date.

5. The system displays the deviation between the trend values computed from received data and the baseline value. This deviation is indicated both as a percentage as well as a numerical difference, along with icons ("+", "-", "=") to visually indicate the trend direction.

Baselines

[0072] 6. The system may be used to calculate a baseline value for each reading type using algorithms specific to each reading type. The user can override the default baseline average by changing the default parameters used to calculate the baseline e.g. the start date and the number of readings. Additionally, the user may directly provide baseline value(s) into the system, overriding the computed baseline values. If the user provides parameters such that there is insufficient data for calculating the baseline, then the system alerts the use to the fact. Previously set baseline values are not altered.

During early use of the system, there may be insufficient data for automatically calculating baselines for the user's reading types. In this case too, the system alerts the user to the fact.

Strength of Trend Correlation

[0073] The system may contain algorithms to compute the strength of the trend and correlate it to the visual perception of the trend as would be observed by a human observer.

[0074] Example Algorithm: In order for a weight trend to be visually perceived as increasing or decreasing, a certain positive or negative standard deviation from a moving average baseline must be observed over a pre-defined time period to be able to inform the user that their weight is either increasing or decreasing.

```
old-baseline = calculate moving average for initial data range
old-standard-deviation = 0

for each subsequent interval
      new-baseline = calculate moving average for updated data range
      new-standard-deviation = standard-deviation(new-baseline, old-
baseline)
      if (new-standard-deviation > 0)
            then trend is increasing
            if standard-deviation(new-standard-deviation, old-standard-
deviation) > 0
                  then strength of trend is increasing
            else strength of trend is decreasing
      else if (new-standard-deviation < 0)
            then trend is decreasing
            if standard-deviation(new-standard-deviation, old-standard-
deviation) > 0
                  then strength of trend is increasing
            else strength of trend is decreasing
      old-baseline = new-baseline
      old-standard-deviation = new-standard-deviation
```

Reminders

[0075] The user may set up reminders on the device(s) via the portal. The device then draws the user's attention at the appointed time e.g. by sounding a buzzer. The mechanism is as follows:

1. Each device associated with the user's account has its own independent set of reminders.

2. Each reminder can be made repeatable. The user can set the reminder to repeat every n <units of time> (where <units of time> may be hours, days etc.) starting from a preset date and time.

3. The reminders are associated with a user's account and are synchronized with the device(s) via the hub. The reminder information is maintained in the control file (see section Device Control File).

4. The user can specify their time zone so as to account for differences between time on the server vs. the user's local time.

Buddy or Role based access

[0076] The user may give permission to others as needed to read or edit their personal data. This is useful, for example, for allowing a well-wisher to view ones data/charts, or receive alerts. The clinician could be allowed to edit data for example to annotate it, while the patient

would have read-only privileges and that too for certain pages. An authorized person could set the reminders and alerts parameters with limited access to others.

[0077] The user or clinician could have a list of people that they want to monitor and have it show on their "My Account" page, which serves as the central monitoring station. The central monitoring concept could be particularly useful in an environment where on person wishes or needs to monitor multiple people.

Clinician Administrator

[0078] A clinician administrator (also referred to as Administrator in this context) may monitor the data for and otherwise administer a number of users of the system (also referred to as Patients in this context). The mechanism is as follows:

1. A summary "dashboard" of readings from all Patients assigned to the Administrator is displayed upon log in to the Portal by the Administrator. At a minimum, the Patient's last reading received from all devices is shown (color coded to visually distinguish normal vs. readings that have generated an alert), along with description of the alert generated.

2. The Administrator may drill down into the details for each Patient to further examine the readings data, view charts etc. in a manner similar to the Patient's own use of the system.

3. The Administrator may also view a summary of all the devices registered to all assigned Patients, including but not limited to all device identification information.

4. An Administrator has access only to information about Patients that have been assigned to the Administrator by a Super Administrator. This allows for segmenting the entire population of monitored Patients amongst multiple Administrators.

[0079] The Super Administrator may assign, remove and/or reassign Patients amongst a number of Administrators.

Patient Questionnaire

[0080] The Portal provides a mechanism to enhance the healthcare interaction and education of the users of the system (also referred to as Patients in this context). The mechanism is as follows:

1. A questionnaire may be made available to the Patient containing questions pertinent to their health condition.

2. The Patient's answers to the questions are stored and tracked by the time of each "session" (user interaction). Statistical summaries of these answers for various intervals of time are available for display.

3. The Administrator (or delegate) defines the entire set of questions that may be made available to all Patients. Of these, pertinent questions are selected based on rules applied to the Patient's recent data in the Repository.

Data Export and Reporting

[0081] Data may be extracted, exported and reported from the Repository into a variety of formats, both application specific and industry standard. The mechanism is as follows:

1. The data in the Repository is internally extracted into a neutral format represented in XML.

2. This data is further processed to either aggregate information or to remove user identification information, as may be the specific requirement.

3. The internal, neutral format may be transformed into custom, application specific formats or industry standard formats depending on specific application requirements.

Software Architecture Specification

Requirements

[0082] The architecture for the web application meets the requirements below. In particular, the architecture must be relatively independent of the user's client environment. At a minimum, the most common browsers (Netscape 4.0 and higher, IE 4.0 and higher) are supported on Windows (95, 98, NT, ME, 2000 now, XP in the near future). In addition, the architecture must be continuously adaptable to support newly emerging and evolving business requirements. This includes changes in the presentation, the business logic as well as the data tier.

In addition, the architecture should meet the following characteristics:

- Scalable to meet performance levels as the user base grows, with the cost of scaling contained for at least 300,000 users.

- Support rapid, iterative development. It is based on the J2EE Blueprints reference architecture with its timeline adapted to our schedule.
- Not require expensive development tools. Most of the development tools are available free as either open source or extended evaluation versions.
- Being based on industry-standard interfaces, it must allow for significant functionality to be purchased off-the-shelf (with integration and possible customization).

[0083] By adapting a standard reference architecture, it allows for the time required for developers to gain familiarity with the architecture to be compressed provided they are well versed in J2EE technology and architecture. This allows for the development effort to be outsourced at a later point in the development cycle. Moreover, the standard architecture, supports rapid and frequent changes to the look of the application. Such an architecture also supports the division of labor amongst the development team e.g. the application is partitioned such that the front-end designer requires minimal programming knowledge and vice versa.

The architecture should also partition the application to allow for the business logic to be accessed via a variety of interfaces e.g. the web (HTML) for now, wireless (WML) and/or voice response (VRU) in the future. It should also accommodate internationalization and localization of the application in the near future without significant changes. In addition, the architecture should leverage emerging technologies to provide a superior user experience e.g. it does not require the user to download, install and configure complicated software by utilizing emerging server-side technology. Moreover, the architecture should have a growth path to allow use of new technology as it becomes available over the application's lifespan (5 years). It should be designed to be resilient for at least the next 1-2 years while accommodating change. Finally, the architecture should not be tied to a particular set of products i.e. any J2EE compatible server can serve as application host. It also is relatively independent of database. This allows for flexibility in choosing and switching between hosting providers.

Technology

Platform

[0084] The Java 2 Enterprise Edition (J2EE) may be used as the standard technology platform for this application. Of the available J2EE components, the initial development

phase may use Java Server Pages (JSPs), servlets, Java Database Connectivity (JDBC), Java API for XML Processing (JAXP). Other J2EE components, such as Enterprise Java Beans (EJBs), transactions APIs etc. may be used as required for subsequent development phases. Using J2EE components has the following advantages:

- Simplified architecture and development
- Scalability to meet demand variations
- Integration with a variety of databases
- Choices of servers, tools, components
- Flexible security model

Relevant J2EE Features and Components

Scalability

[0085] J2EE provides mechanisms that support simplified scaling of distributed applications, without requiring significant effort on the part of the application development team. Because application services such as transaction support, database connections, life cycle management etc. are provided by the platform, the application can leverage these capabilities by adhering to the rules requiring it to be compatible with these services. For example, by using the appropriate JDBC APIs, connection pooling is automatically available for increased performance. Similarly, J2EE servers now provide many scaling mechanisms that were previously designed by the application developer.

Declarative Security

[0086] Security (access restriction, authentication) is configured declaratively at deployment time instead of being coded at development time. This allows for continuous refinement of the security mechanism (matching users with roles, with groups of users having specific access permissions) without requiring changes to the code followed by redeployment. For comparison, commercial products providing these kinds of capabilities for web applications (e.g. getAccess from Entrust Technologies) are typically priced at $15-$25 per user for quantities less than 5000 users.

Expandability

[0087] As the functionality provided by the J2EE expands, these capabilities are immediately available for use by the application. For example, the Connector architecture in the upcoming

release of the J2EE will provide built-in capabilities of communicating with legacy systems (once commercial implementations are available).

Supported by Hosting Services

[0088] There are several commercial and open source implementations of J2EE compatible servers with the result that most hosting services offer reasonably priced hosting packages for J2EE applications.

Other Enabling Technologies and Products

Page Layout and Rendering

Flash

[0089] The pages should be as lightweight as possible while being aesthetically pleasing. This leads to using Flash as the rendering technology for items such as buttons and image maps etc. since this leads to compact graphics. However, there are no large animations.

CSS

[0090] The pages should not be hard-coded for a particular user screen size i.e. pages may be designed using Cascading Style Sheets (CSS).

Charting

[0091] Popchart (http://www.popchart.com) from Corda may be used to provide charting functions. It runs as an image server and services requests for charts from the web server over a pre-configured TCP port. It supports multiple output formats (including Flash, WML and SVG) and good chart interaction such as pop-up text and drill-down. The charts can be visually designed by a graphic designer and later rendered programmatically.

Reporting (Printing)

[0092] The reporting technology/product should support the following requirements:

- It must be able to produce charts similar in nature to those produced on-screen for the user.
- It must be able to export the user's data in Excel format for download.
- It must be able to provide the user with the facility to print a report on his/her local printer.

- It must be able to provide the user report in PDF format for use as an e-mail attachment.
- The final choice of product is still pending. Among the products evaluated include Formula One from Tidestone Technologies and Style Report from Inetsoft Corp.

Development Tools

User Interface

Visual Design

[0093] Dreamweaver software may be used as a tool for developing the front-end HTML. Flash and (optionally) Fireworks software can be used along with Dreamweaver. MS Frontpage software, although popular, is not preferred since it introduces irrelevant HTML into each document.

Chart Design

[0094] Popchart software (see section Charting above) includes a graphics chart builder that allows charts to be interactively designed. The designer may use this builder to create aesthetically pleasing charts.

HTML Validation

[0095] All HTML should pass validation for acceptance. Tidy is one utility that can check HTML for validity.

Web Server

[0096] An Apache web server may be used for development. The deployment web server is provided by the hosting service.

Servlet Engine

[0097] Tomcat software may be used for development due to it providing integrated debugging with many IDEs (Integrated Development Environments) and its smaller memory footprint when compared with other similar commercial products.

Framework

J2EE Blueprints (JPS)

[0098] The current application architecture is modeled after the J2EE Blueprints reference application (the Java Pet Store version 1.1.1). Although EJBs are not used at this stage, the tier separation is maintained to allow them to be introduced at a later stage.

com.oreilly.servlet

[0099] This is a collection of utility classes available at www.servlets.com that may be useful in servlet development. Developed and maintained by Jason Hunter, author of the book Java Servlet Programming, 2nd Ed. (must read).

Java Code

Integrated Development Environment

[00100] Forte for Java, Community Edition may be used because it provides a rich feature set for free. JRun Studio has also been evaluated and may be used if we switch to JRun in a later development phase.

JSP Tag Libraries

[00101] Tag libraries from the Apache – Jakarta (and the Struts framework) project may be used if needed. Proprietary taglibs will not be used. Taglibs should be used if their use results in significant effort saving.

Code Documentation

[00102] Javadoc.

Build Tool

[00103] Any industry standard build tool (such as Ant or make) can be used as the build tool.

Unit Testing

[00104] The JUnit unit-testing framework (www.junit.org) may be used to unit test all developed code. Extensions to JUnit for server-side testing and J2EE testing (e.g. HttpUnit, Cactus) may also be used.

Database

[00105] Either Oracle or MS SQL Server 2000 may be used as the database. It is important to be careful to not have dependencies on the database to allow for switching if required by hosting providers.

Process Control

Configuration Management

[00106] Visual SourceSafe or CVS may be used. CVS is accessible over the Internet.

Bug Tracking

[00107] EbugStomp software may be used for web-based bug tracking.

Application Architecture

Request and Response Flow

[00108] This section describes the architecture of the application: exploring the partitioning of functionality into modules, the assignment of functionality to tiers, and object decomposition within the tiers.

Application Structure

Modules

[00109] This is a list of the functional modules of the system. Some of the modules are relatively simple but have been broken out to provide an idea of the broad functional areas of the application.

Control Module

[00110] This module provides the basic framework for the other functional modules. It provides key features such as navigation, security etc.

User Account Module

[00111] This module maintains information about a person's account (contact information, payment and credit card information) as well as the devices associated with a particular account.

User Profile Module

[00112] This module maintains information about a person's profile such as demographic information, medical conditions, medications and allergies.

Device Information Module

[00113] This module maintains information about the various types of devices supported by the system.

Data Synchronization Module

[00114] This module provides the functionality to upload the newly acquired readings data from a user's PC to the server. It flags potentially erroneous readings and provides a preview of the data so that the user may optionally reject some readings. Please refer to the section Data Synchronization between User's PC and Server for more details.

Data Management Module

[00115] This module manages the data obtained for each user. It also provides functionality to associate annotations with data points.

Data View: Charts Module

[00116] This module provides the functionality for the user to view his/her readings data as charts. The user may choose to view either preset ranges of data or choose an arbitrary range.

Data View: Tables Module

[00117] This module provides the user with a tabular view of their data. There are no complex table-editing functions.

Trends Module

This module contains the logic to provide the user indication of certain trends in their data.

Alerts Module

[00118] This module provides the functionality where the user can select from preset patterns to look for in the data to be alerted about. The user may choose certain parameters of the triggering events e.g. if their blood pressure is above X for Y days, then trigger an alert, where X and Y are chosen by the user.

Reminders Module

[00119] The reminders module generates preset reminders to a user about certain events that were supposed to have occurred but have not.

Groups Module

[00120] This module will provide functionality in which the user can choose to invite another registered user to be a part of his/her group. The invited user can then have access to the inviting user's data.

E-Mail Module

[00121] This module provides the functionality to send e-mail arising from a number of places in the application: when an alert is generated, for sending a user report etc.

Report Module

[00122] The report module will provide functionality to generate simple reports for the user incorporating charts.

Print Module

[00123] This module will provide the functionality to print on the client PC.

Export Module

[00124] This module provides the capability to export the user's data in Excel format.

Interfaces

[00125] The web application will have the following interfaces with external systems. These interfaces may be either synchronous (i.e. online, in real time) or asynchronous (i.e. as a batch operation, deferred in time).

Interface with Credit Card System

[00126] The application will transmit the user's credit card number and obtain online verification. It will also make periodic charges to the credit card as the user's account is automatically renewed on expiry.

Interface with E-Store

[00127] An outsourced e-store will provide the capability for a user to buy a device online. The application should be able to transfer information such as credit card information

etc. to this system. Additionally, the front-end for such a system needs to be created and integrated with the rest of the application.

Interface with Refund Generation System

[00128] This system will generate pro-rated refund checks for users canceling their accounts. The application must transfer the required information to this system.

Interface with Customer Support System

[00129] A customer support system providing (at least) e-mail based support needs to be integrated with the application/site.

Interface with Device Control Software on the User's PC

[00130] At this time, the interface with the device control software running on the user's PC is asynchronous and is handled by uploading and downloading files to a known location on the user's disk. This will eventually be enhanced to obtain the file location from the Windows registry.

Key Mechanisms

Business Object Framework

[00131] The Business Object Framework (BOF) is designed as a lightweight stand-in for Enterprise Java Beans (EJBs). The idea is to create structural parallels with the EJB component structure (such as the home and remote interfaces, session and entity beans etc.) in a simple object framework that allows for easy migration to EJBs at a later time. The key differences between EJBs and BOs are:

[00132] There is no container that the BOF objects (and their derived objects/components) run in. Because of that, BOF-derived objects must manage their own lifecycle such as creation and destruction. This is however minimal and is abstracted behind utility (factory) methods.

[00133] BOF-derived objects are generically referred to as BOs (for business objects) and are packaged in the bo package within the application structure. The scope of BOs is the same as for regular Java objects. This is different from EJBs, whose scope is controlled by the container and managed by methods on the home interface. The BO implementation objects must directly implement the BOF equivalent of the remote and home interfaces i.e.

the BOInterface and BOHome. This is a key distinction from EJBs, in which the implementation object does not directly implement its home and remote interfaces.

[00134] The methods in the BOHome that are implemented by the BO have the same names as defined in the interfaces. This is different from EJBs which have a naming convention of prefixing ejb to the method name e.g. ejbCreate for a method named create in the home interface. BOs extend either the SessionBO or EntityBO base class. This is different from EJBs, which instead implement either the SessionBean or EntityBean interfaces. BOs are not remotely referenced and execute in the local JVM instead.

Components

[00135] The BOF has the following main types of components as set forth below:

Business Object Interface

[00136] This is the equivalent to the EJB remote interface. All business process methods are defined in this interface. Interfaces of this type extend com.carematix.bof.BOInterface and are named per the EJB convention i.e. using the domain class name. The BO must implement this interface directly.

Business Object Home (Interface)

[00137] This interface is the equivalent of the EJB home interface. At the very least, it must define a create(...) method to return a concrete BO object implementing the BOInterface. Interfaces of this type extend com.carematix.bof.BOHome and are named per the EJB convention i.e. by appending "Home" to the domain class name. The BO must implement this interface directly.

Business Object

[00138] This is the abstract base class (com.carematix.bof.bo) for Session Business Objects (SBOs) and Entity Business Objects (EBOs) described below.

Session Business Object (SBO)

[00139] An SBO is the equivalent of a session EJB. One key distinction is that SBOs can only be stateless, not stateful beyond the scope of the calling method. It is best to assume them as stateless. Typically, SBOs define most of their methods in the BOInterface and have just a simple create() method in the BOHome interface. A session BO extends the base class com.carematix.bof.SessionBO.

Entity Business Object (EBO)

[00140] An EBO is the equivalent of an entity EJB and encapsulates some persistent data representation. Typically, EBOs have a simple BOInterface and have most of their methods in the BOHome interface such as create(...), load(...), store(...), remove(...), findByPrimaryKey(...) etc. Not all of these methods are required in every EBO and only those needed by the application must be defined. An entity BO extends the base class com.carematix.bof.EntityBO.

Examples

[00141] Source code for the placeholder classes comprising the BOF is available. Accompanying that are two example packages: boexample1 and boexample2. These provide example implementations for a session BO and entity BO respectively. They illustrate the patterns and conventions required to create BOs and should be thoroughly studied.

Usage

[00142] In order to access a BO from calling code, the following example of a handler method for handling account events is illustrative:

```
public void perform(PWMAppEvent event) throws PWMAppEventException
{
  AccountEvent ae = (AccountEvent)event;
  ...
  switch (ae.getActionType())
  {
    case AccountEvent.CREATE_ACCOUNT:
    {
      try
      {
            UserHome userHome = BOUtil.getUserHome();
            User user = userHome.create();
            user.createAccount(ae.getUserId(), ...);
```

```
                ...
            }
            catch (DuplicateKeyException dke)
            {
                ...
            }
            // Catch more exceptions
        }
    }
}
```

Deployment

[00143] Entries need to be created in the web.xml file for each BO in order to enable JNDI lookup. Entries for the BO examples are as follows:

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE web-app PUBLIC '-//Sun Microsystems, Inc.//DTD Web Application 2.2//EN' 'http://java.sun.com/j2ee/dtds/web-app_2.2.dtd'>
<web-app>
  ...
  <env-entry>
    <env-entry-name>bo/boexample1/Example1</env-entry-name>
    <env-entry-type>java.lang.String</env-entry-type>
<env-entry-value>com.carematix.boexample1.bo.Example1SBO</env-entry-value>
  </env-entry>
  <env-entry>
    <env-entry-name>bo/boexample2/Example2</env-entry-name>
    <env-entry-type>java.lang.String</env-entry-type>
<env-entry-value>com.carematix.boexample2.bo.Example2EBO</env-entry-value>
```

```
</env-entry>
<env-entry>
<env-entry-name>bo/boexample2/Example2DAOClass</env-entry-name>
<env-entry-type>java.lang.String</env-entry-type>
<env-entry-value>
com.carematix.boexample2.dao.Example2DAOImpl</env-entry-value>
</env-entry>
...
</web-app>
```

Template Mechanism

[00144] The XML-based templating solution provides many benefits. XML is a useful, consistent way of representing application parameters. The XML format is easy to use for both presentation specialists and third-party tools. The fact that XML is standardized means we can use off-the-shelf software to handle all the details of parsing and writing our screen definitions, configuration files, and other forms of structured data. Finally, XML can be validated against a DTD (Document Type Definition), so the parser can handle errors relating to ill-formed input, instead of in the application code.

[00145] Three files control the templating system:

- The template file (template.jsp), which defines the basic layout of all of the pages generated from the template. There is one template file per supported language.
- The request mappings file (requestmappings.xml), which maps virtual URLs to screen names (or request handler classes). There is one request mappings file in the application.
- The screen definitions file (screendefinitions.xml), which defines the parameters for each screen. There is one screen definitions file per supported language.

[00146] The main controller servlet MainServlet receives incoming HTTP requests. MainServlet matches the incoming url to the URLs defined in the request mappings file, obtaining a screen name. The template parameters corresponding to the screen name are retrieved from the screen definitions file, and the template is then served using those

parameters. The MainServlet does not do all of the work. Most of the work is delegated to other classes that specialize in screen flow management, template instantiation, and the like.

[00147] The XML files in the templating system are parsed by a standard XML parser, created using the JAXP (Java API for XML Parsers) optional package. The template is served as a JSP page, and the inclusion of the dynamic content occurs because the JSP engine calls the custom tag <j2ee:insert> each time it occurs.

[00148] In a Web application, each screen presented to the user can be considered as a different view. However, unlike the classic MVC architecture, all these views share the same controller. There needs to be a mechanism that allows the controller to choose a particular view to render in response to a user request. In the sample application, the controller makes this selection by specifying the screen ID of the screen to present as the response. This screen ID is mapped to a screen definition, then the template is instantiated. Recall that the file template.jsp defines the template for the sample application. This file includes another file, ScreenDefinitions.jsp, which defines all the screens of the sample application. When the controller invokes the template file at request time, it sets the appropriate screen definition in the request scope. The template file passes this information to the screen definitions file which then returns the appropriate screen definition for the request. One goal in structuring template and screen definition files is to facilitate internationalization (discussed in Section 4.5). This is achieved by separating text content from Java code. Since screen definitions that contain direct and indirect parameters are candidates for internationalization, we want to keep ScreenDefinitions.jsp devoid of Java technology code. We achieve this through the use of JSP custom tags.

Data Access Mechanism

[00149] The application uses a bimodal data access mechanism to increase efficiency of data access. Since it is anticipated that the majority of data access will be read-only (50% or more, as a conservative estimate), the data access mechanism will not utilize a transactional component for reading, relying instead on direct JDBC access to reduce overhead. Conversely, data updates will still continue to rely on a transaction component. When a transactional update does occur, the model will be refreshed from the data store and a model update event propagated to all registered views to update themselves, ensuring data display consistency.

Data Synchronization between User's PC and Server

[00150] The functional specifications for the data synchronization mechanism are listed below, followed by details on each of the components that implement the mechanism. In cases where the implementation details of a component is not yet decided (such as whether to use an applet or not on the client PC), it is referred to generically (e.g. data sync client).

Functional Specifications

[00151] When a user logs on to the home page (FIG. 17) using the PC the data file is uploaded to server. The server filters duplicate readings records. The records are decrypted on the server, assigned to each user (by determining which user the device is registered with) and put into a staging area. This staging area is so that the user may optionally preview the data before accepting the values. The device control file is uploaded to the server. The server downloads updated device control file with last updated timestamps for each device in list. If device has been removed from the system, then its entry in the file is deleted. The old device list file is backed up. The data file is cleared/deleted. If a user has logged onto the site for the first time from this PC, then a new control file is downloaded. This control file will contain entries for the registered devices of the current user only and will be built up as other users log into the PC. Similarly, when a user registers a device, its entry is added to the control file on the PC if not already there.

[00152] For this phase of implementation, the locations of the control file and the data file on the user's PC is fixed. Note the following:

- No association information between the user and the device is kept on the user's PC. This determination is made after the data is uploaded to the server by matching the device id against the RegisteredDevice table.
- Data for all users (i.e. from all devices in the control file) is uploaded to the server, regardless of the user logged on.

Device Control File

[00153] This file contains records in the format

<device id>, <data update timestamp>

where <device id> is all the information required to uniquely identify a device to the system (such as manufacturer number, model number, serial number and user number) and the <data update timestamp> is the timestamp (including date) that data for this device

was last received by the server. Note that this is not the timestamp for which data was last uploaded from this particular PC (on which the control file resides) but is the timestamp for which the server last received data (from any user PC) for the particular (registered) device.

User Data File

[00154] This file contains records in the format

[00155] <device id>, <reading timestamp>, <reading data>

[00156] where <device id> is as described in the section Device Control File. The <reading timestamp> is the time of the reading and the <reading data> is a data record in a format specific to the type of reading. Each record in the file is individually encrypted (encryption to be implemented in a subsequent phase) and is appended to the end of the file. Note that data for all users is aggregated in the same file.

Data Synchronization Client

[00157] This client runs on the user's PC to handle the file operations to and from the server such as uploading and downloading, checking for file existence, creating backup files etc. Note that these are all file operations and do not require any business logic in this client. All of the business logic decisions are made at the server and the appropriate files are downloaded. This allows for the client to be implemented as a signed applet.

[00158] A standalone Data Synchronization Client that does not require a PC and is directly able to connect to the server via a network connection is developed by embedding the synchronization logic in the firmware of a microcontroller and using it to connect to the server through a connection established either via a phone line (which requires an embedded modem) or via a connection established by another network terminal such as a web-phone or video-phone to which the Data Synchronization Client is connected.

Data Synchronization Manager

[00159] The Data Synchronization Manager component runs on the server and is the primary interface between the Data Synchronization Client and the rest of the application. Its primary operations include: receiving upload of the data file from Data Synchronization Client; decrypting the data records; determining which user each record belongs to (from RegisteredDevice mapping); putting each user's respective records in staging area (table) for user preview if so specified. This function is actually delegated to the ReadingsManager; putting each user's respective records in data tables if user does not want preview. This

function is actually delegated to the ReadingsManager; signaling Data Synchronization Client to delete data file; receiving upload of control file; if control file does not exist, then creating it initially; updating control file with last uploaded timestamp for each registered device; downloading updated control file to Data Synchronization Client.

[00160] The Data Synchronization Manager has the following invocation points:

- On user login.
- On user registering one or more device(s).
- On user previewing uploaded data prior to accepting it.
- On an embedded Data Synchronization Client connecting to the server.

[00161] The Data Synchronization Manager is implemented as a Session BO as well as a standalone server application known as the iModem server.

IModem Server and Protocol Specification

[00162] The key attributes and mechanisms of the iModem server (i.e. Data Synchronization Manager for standalone Data Synchronization Clients) are:

- Accept multiple connections over the same server port at the same time: This will happen (in production) since more than one iModem could be connecting to the server and will require that the server be multi-threaded, using an independent thread for handling each connection. This is somewhat analogous to how web servers handle HTTP, which is a stateless protocol wherein several clients connect over the same port (80) at the same time. This also implies that the port number to which the iModem connects will remain constant.

- Build in a versioning scheme into the protocol: This allows for upgrades over time without breaking backward compatibility.

- Provide a status value in each message response. Zero indicates OK, non-zero values indicate various error conditions.

- Error handling: There must be enough error handling and recoverability that a user's data is never lost and that each end (iModem or server) can signal to the other that data transfer either occurred or not. There must also be timeouts to handle conditions when no response is achieved. The value of the timeout (in seconds) must be a parameter read from a configuration XML file.

- Break down current messages into multi-step messages: This is to handle two basic limitations: 1) each message to and from the iModem must be less than 256 bytes and 2) the iModem embedded code is more efficient in parsing fixed-length responses rather than variable length responses.

- Encryption and keys: A basic mechanism (using placeholders as necessary) needs to be put in place such that in case the data stream is intercepted by a third party, all information that is private to the patient (such as reading values) and all information that can be correlated to deduce the message format (such as device identification information) is scrambled or encrypted.

[00163] This servlet is a "listener" for an embedded internet-modem (iModem) that has established a dial-up connection with a PPP server and is then communicating over TCP/IP to a specific server and port. The primary purpose of this servlet is to accept TCP connections over the specified port, parse the data coming over the connection and return responses. It also does basic connection management of connections and sockets as necessary. The incoming data stream comprises a series of messages in a simple protocol detailed below. This servlet parses the data stream, decodes the protocol message and responds based on logic detailed below. In summary, this servlet serves as a protocol handler for the iModem hub data transmission, which is done over TCP/IP sockets.

IModem Protocol.

[00164] The data protocol is a variant of the data exchange (XML) protocol that is used by the main web application for data interchange (defined by the files devicecontrol.xml and readingsdata.xml, hereafter referred to as the Datasync protocol). It differs from the Datasync protocol in the following manner to allow for the limited processing requirements of the iModem hub:

[00165] Numeric values are specified as hexadecimal text with each byte value comprised of 2 ASCII characters i.e. a decimal value 1085, which is 43D hex (or 043D hex, more accurately), will be specified as the characters '0', '4', '3' and 'D'. The most significant byte (MSB) is first when decoding multi-byte values.

[00166] Descriptive tags in the Datasync protocol are replaced with 4-digit hexadecimal numbers referred to as tokens. E.g. a <control-entry> tag may be denoted as

<04AD>[1]. The mapping of the tags in the Datasync protocol to the iModem protocol must be configurable via another XML file (tagmappings.xml) so that it may be changed as the protocols evolve. End tags are denoted by a 4-digit hex number that is calculated by setting the most-significant-bit (MSB) of the number denoting the start tag. This defines the start tag and end tag relationship of the iModem protocol.

[00167] Readings are sent serially as a series of Readings Data messages (see below). This is given the current limitation of the iModem restricting the message length to be less than 256 bytes. The server response is either a success or error indicator.

[00168] All timestamps are in seconds elapsed since 1/1/1970, denoted as a 4-byte number and encoded as the ASCII representation of the hex digits, MSB first. There is an additional command for getting the current server time that is not part of the Datasync protocol. The details of this message are defined below, with a descriptive tag being used in place of a token for illustration purposes.

Initiate Session

Command

<initiate-session><hub-id>*H3H2H1H0*</hub-id><protocol-version>*P1P0*</protocol-version></initate-session>

Response

<initiate-session><status>S1S0</status><current-time>*T3T2T1T0*</current-time><update-flag>*F0*</updateflag><key>*K1K0*</key><initate-session>

Details

[00169] The HubID is an identifier that is encoded in the iModem hub and is transmitted as a means of identifying itself. It is a long i.e. 4 byte number. This ID will be populated in the database through the device registration UI (which will be enhanced to support this later) and is used to associate a user (and his registered devices) with a specific hub.

[00170] On receiving this message, the server should set up a "session" with this connection and Hub ID and return a status code of 0000 in the response. All subsequent messages coming over this connection are considered in the context of the established

[1] The angle braces <> will still be used to surround tags

session. If an unrecognized Hub ID is received, a status code of 0001 is returned with other message data being same. The <protocol-version> value is two byes, with the MSB being the major version and the LSB being the minor version. So currently, this value would be 0101 (current version is 1.1 => 1 << 8 + 1 = 257 decimal = 0101 hex, formatted as 2 characters for each byte).

[00171] The response returned is the current server time, in seconds elapsed since 1/1/1970. It is a 4-byte number and is encoded as the ASCII representation of the hex digits, MSB first.

[00172] There are two additional fields added for version 1.1. These are the update-flag and key. <update-flag> is a byte value that is used to signal to the iModem that there are parameter updates (see message Parameter Updates) that it needs to query for. The intent is to provide a way for parameters such as dial out numbers, dialing prefixes etc. to be provisioned via a web interface and indicated to the iModem so that it can update its own memory-based parameters. For version 1.1, the value returned is always 00 (zero).

[00173] The <key> is a placeholder value for now. It is a 16 bit number and its value is always 0000 (zero).

Parameter Updates

Command

<param-updates></param-updates>

Response

<param-updates><status>S1S0</status></param-updates>

Details

This is a placeholder message for now and will be expanded in future protocol revisions. The status code is always 0000.

Readings Data

Command

<readings-data><reading-record><device-id><manufacturer-no>*M2M1M0*</manufacturer-no><device-model>*D2D1D0*</device-model><serial-no>*N3N2N1N0*</serial-no><user-no>*U0*</user-no></device-id><timestamp>*T3T2T1T0*</timestamp><reading><reading-type>*BP-HR*</reading-

type><units>*mm Hg*</units><values><bp-systolic>*V0*</bp-systolic><bp-diastolic>*V0*</bp-diastolic><pulse-rate>*V0*</pulse-rate></values></reading></reading-record></readings-data>

Response

<readings-data><status>*S1S0*</status></readings-data>

Details

[00174] This message is a fixed-format equivalent to the *readingsdata.xml* file containing a single reading. The appropriate token values (as set up in tagmappings.xml file) are used for `<reading-type>` and `<units>` tag values.

[00175] The `<status>` value is a 16-bit integer. The value 0000 (zero) indicates no error whereas non-zero values indicate error conditions. Currently, only the value 0001 is assigned as a general error indicator. This list of values will be expanded over time and the code should be written to allow for it without significant change.

[00176] Because the iModem requires a fixed-length, fixed-format data command, the server must do some conversion/transformation to derive the application-specific XML `<readings-data>` command. The iModem will always send all data (BP, weight or blood sugar) in the format described above (for BP). The only difference for weight and blood sugar will be that the `<reading-type>` and `<units>` will correspond to the type of reading, so that for weight, `<reading-type>` value is `WEIGHT` and `<units>` value is `POUNDS` and for blood sugar, `<reading-type>` is `BLOODSUGAR` and `<units>` value is `mg/dL`. The value of the reading is derived from the byte values contained in the `<bp-systolic>`, `<bp-diastolic>` and `<pulse-rate>` tags. Because of this, the `<value>` tag is no longer required.

[00177] The server must use the following algorithm/logic to convert these fixed format iModem <readings-data> commands to the Datasync protocol's <readings-data> messages:

```
if (reading-type == BP-HR)
      then translate iModem <readings-data> message directly into Datasync
<readings-data> message
else if (reading-type == WEIGHT)
      then
            value = ((<bp-diastolic> << 8 + <bp-systolic>) >> 6) * 2.2
            // this value is in POUNDS, << & >> are left-shift & right-
shift operations
else if (reading-type == BLOODSUGAR)
      then
            value = <bp-systolic>
```

Number of Devices

Command

<device-control-list></device-control-list>

Response

<device-control-list><status>S1S0</status><num-devices>*N0*</num-devices></device-control-list>

Details

[00178] This command is used to obtain the number of devices currently registered by the user. The status is generally expected to be 0000, non-zero indicates an unspecified (as of yet) error.

Device Information

Command

<device-info><device-num>*N0*</device-num></device-info>

Response

[00179] <device-info><status>S1S0</status><control-entry><device-id><manufacturer-no>*M2M1M0*</manufacturer-no><device-model>*D2D1D0*</device-model><serial-no>*N3N2N1N0*</serial-no><user-no>*U0*</user-no></device-id><reminders></reminders><first-association-timestamp>*T3T2T1T0*</first-association-timestamp><last-update-timestamp>*T3T2T1T0*</last-update-timestamp></control-entry></device-info>

[00180] Details

[00181] The iModem sequentially requests device details for each device registered by the user, passing in a device number (actually, device index) as part of the command. The list

is zero-indexed i.e. the first device is 0 (zero) and the index increments sequentially from there. The information in the response is the same as a single-entry device control file. Currently, nothing is returned for reminders (even if there are some set) since the iModem is not set up to handle them. These will be handled in a subsequent protocol revision.

Terminate Session

Command

<terminate-session></terminate-session>

Response

This command does not return a response.

Details

[00182] This command is for the iModem to indicate to the server that it is done with the session prior to terminating the connection so that the server may release resources and perform other cleanup. The server does not return a response to this command since the client's state is undefined after this. It releases resources and terminates the server's socket connection.

Reminders

[00183] Reminders are in a slightly different format from the Datasync protocol. The structure is as follows:

<reminders><reminder><start>*T3T2T1T0*</start><repeat>*nn*</repeat><for>*nn*</for> </reminder>...</reminders>

where ... denotes more reminder records, each delineated by a <reminder></reminder> sequence. Each reminder block is part of the <control-entry> block. The <repeat> value is the number of seconds to repeat the reminder after the start. It is zero if there is no repetition. The <for> value is the number of times this repetition must be carried out. It too is zero if there is no repetition.

Chart Creation and Display

[00184] The chart creation and display mechanism is comprised of collaborating objects and components across all four application tiers (view, web, business object and data persistence tiers). As previously mentioned, Popchart is the charting server being used to

render the data for display in the Flash format. This requires the Flash plug-in to be installed in the client browser, which the majority of the browsers (over 90%) already do.

[00185] The approach to chart creation and display is to isolate dependency on Popchart in the view tier only. This is to allow change over to another charting product if required later. Doing this requires encapsulating all code to create a Popchart chart in presentation components in the view tier. All the information (data) required to produce the chart is kept as generic objects or components and supplied to the view components via the standard application framework. This mechanism is elaborated upon below.

The View Tier

[00186] This tier is comprised of the JSP page containing the chart as well as an embedded JavaBean that converts the chart model objects into Popchart specific instructions (there may be the need to do specific JavaBeans for each chart type but the approach will remain the same for each). This JavaBean encapsulates the logic to create Popchart instructions from the chart model objects and isolates the dependency on Popchart.

[00187] The Popchart JSPExample demonstrates such a JSP/JavaBean combination. The key points of difference are:

- The example code has a lot of hard-coded elements such as label information etc. All this information is being supplied in the chart model object(s) instead.

- The example code has a lot of direct database access for retrieving data. All data required to create the chart will be supplied through the chart model object(s) or in objects directly associated with them. Some of these data objects would be the domain model objects themselves e.g. the Range object would contain the range of reading values to be charted.

The Web Tier

[00188] This tier contains the standard web handler for processing user input to the chart (such as when a user displays the chart, changes the date range, clicks on a point for annotation or drill-down etc.). The handler creates a chart event object (class ChartEvent) encapsulating the user request and forwards it to the Business Object tier for handling.

[00189] Note that there may be requests that can be handled in the web tier itself instead of having to go to the BO tier. For example, the user may choose to view a data range that is a subset of the range already displayed. In this case, there is no need to go to the BO

tier to get data for display since the data has already been sent to the web tier in the chart model object(s). The web tier handlers need to be intelligent enough to check for these cases in order to improve application performance.

The Business Object Tier

[00190] This tier contains the components required to handle chart events generated from the web tier. The main façade component is a session BO named ChartManagerSBO. This BO interprets the chart event and creates/retrieves the chart model objects that are required to generate the requested chart. It invokes the ReadingsManager to get the actual readings model objects. This BO also provides the defaults for chart presentation.

[00191] The chart model objects also belong in this tier. These objects encapsulate the complete information required to render the chart. This includes information about the various chart display paramters as well references to the model objects that hold the actual data for display. The data used to populate the chart model is obtained from the chartconfig.xml file using a DAO implementing the ChartDAO interface.

[00192] The chart model object is mutable i.e. it can be changed when a user adds or changes annotations on data points. The annotation actually changes a particular reading referenced by the range, which is in turn referenced by the chart model object.

Implementation Notes

[00193] Popchart servlet redirector may be used.

[00194] The implementation DAO object actually is ChartXmlDAOImpl, meaning that it reads the XML configuration file.

[00195] The elements in the chart model object that are specific to the charting product are kept as properties so as to not make the structure of the model object dependent on product-specific attributes.

Patterns

[00196] Following are the design patterns utilized in the architecture. Further details can be found in publicly available J2EE Blueprints documents as well as in a book, entitled **"Design Patterns", by Vlissides, Gamma, et al** and are thus elaborated upon further here.

Model-View-Controller (MVC)

Data Access Object (DAO)

Bimodal Data Access

Front Component

Value Object

File Formats

Device Control File

[00197] This file is currently in plain text XML format. It may later be stored encrypted if necessary. It does not currently have a DTD and therefore requires a non-validating parser. For now, the URI for this file is file://c:\carematix\config\devicecontrol.xml.

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<device-control-list>
 <control-entry>
   <device-id>
        <manufacturer-no>12345</manufacturer-no>
        <device-model>67890</device-model>
        <serial-no>555555555</serial-no>
        <user-no>1<user-no>
       </device-id>
   <last-update-timestamp>06-05-2001 11:21:33</last-update-timestamp>
 </control-entry>
<!-- More <control-entry> records for all other devices that users of
   this PC have registered with Carematix.
-->
</device-control-list>
```

User Data File

[00198] This file is currently in plain text XML format. It may later be converted into a format in which each XML <reading-record> entry is encrypted and stored as a fixed length

record, with new records being appended to the end. It does not currently have a DTD and therefore requires a non-validating parser. For now, the URI for this file is file://c:\carematix\data\readingsdata.xml.

Note: This file may contain duplicate <reading-record> entries. That is allowed.

```
<readings-data>
 <!-- Reading record for blood pressure and heart rate reading -->
 <reading-record>
   <device-id>
        <manufacturer-no>12345</manufacturer-no>
        <device-model>67890</device-model>
        <serial-no>555555555</serial-no>
        <user-no>1<user-no>
   </device-id>
   <timestamp 06-05-2001 11:21:33 PM/>
   <reading>
        <!-- The reading-type tag may be eliminated later -->
    <reading-type>BP-HR</reading-type>
        <values>
         <bp-systolic 120 />
         <bp-diastolic 80 />
         <pulse-rate 72 />
        </values>
   </reading>
 </reading-record>
 <!-- Reading record for temperature reading -->
 <reading-record>
```

```
<device-id>
    <manufacturer-no>29933</manufacturer-no>
    <device-model>68909</device-model>
    <serial-no>123456789</serial-no>
    </device-id>
<timestamp 06-05-2001 11:21:42 PM/>
<reading>
    <!-- The reading-type tag may be eliminated later -->
 <reading-type>TEMP</reading-type>
    <!-- The units for temperature are FARENHEIGHT or CELCIUS -->
    <units FARENHEIGHT />
    <value 98.7 />
</reading>
</reading-record>
<!-- Reading record for weight reading -->
<reading-record>
  <device-id>
    <manufacturer-no>29890</manufacturer-no>
    <device-model>68309</device-model>
    <serial-no>123456789</serial-no>
    </device-id>
<timestamp 06-05-2001 11:25:42 PM/>
<reading>
    <!-- The reading-type tag may be eliminated later -->
  <reading-type>WEIGHT</reading-type>
    <!-- The units for weight are KILOGRAMS or POUNDS -->
```

<units KILOGRAMS />

<value 65 />

</reading>

</reading-record>

... more reading records from all devices (and all users)

</readings-data>

XML to iModem Tag Mappings

<tag-mapping type="request" xml-tag="readings-data" imodem-tag="0000"/>

<tag-mapping type="request" xml-tag="reading-record" imodem-tag="0001"/>

<tag-mapping type="request" xml-tag="reading" imodem-tag="0002"/>

<tag-mapping type="request" xml-tag="reading-type" imodem-tag="0003" byte-length="1">

<tag-token xml-token="BP-HR" imodem-token="04"/>

<tag-token xml-token="TEMP" imodem-token="05"/>

<tag-token xml-token="WEIGHT" imodem-token="06"/>

<tag-token xml-token="BLOODSUGAR" imodem-token="07"/>

</tag-mapping>

<tag-mapping type="request" xml-tag="values" imodem-tag="0004"/>

<tag-mapping type="request" xml-tag="bp-systolic" imodem-tag="0005" byte-length="1"/>

<tag-mapping type="request" xml-tag="bp-diastolic" imodem-tag="0006" byte-length="1"/>

<tag-mapping type="request" xml-tag="pulse-rate" imodem-tag="0007" byte-length="1"/>

<tag-mapping type="request" xml-tag="units" imodem-tag="0008" byte-length="1">

<tag-token xml-token="mm Hg" imodem-token="00"/>

<tag-token xml-token="Kelvin" imodem-token="01"/>

<tag-token xml-token="POUNDS" imodem-token="02"/>

<tag-token xml-token="mg/dL" imodem-token="03"/>

</tag-mapping>

<tag-mapping type="response" xml-tag="current-time" imodem-tag="0009" byte-length="4"/>

<tag-mapping type="common" xml-tag="device-id" imodem-tag="000A"/>

<tag-mapping type="common" xml-tag="manufacturer-no" imodem-tag="000B" byte-length="3"/>

<tag-mapping type="common" xml-tag="device-model" imodem-tag="000C" byte-length="3"/>

<tag-mapping type="common" xml-tag="serial-no" imodem-tag="000D" byte-length="4"/>

<tag-mapping type="common" xml-tag="user-no" imodem-tag="000E" byte-length="1"/>

<tag-mapping type="common" xml-tag="device-control-list" imodem-tag="000F"/>

<tag-mapping type="response" xml-tag="control-entry" imodem-tag="0091"/>

<tag-mapping type="response" xml-tag="reminders" imodem-tag="0092"/>

<tag-mapping type="response" xml-tag="reminder" imodem-tag="0093"/>

<tag-mapping type="response" xml-tag="start" imodem-tag="0094" byte-length="4"/>

<tag-mapping type="response" xml-tag="repeat" imodem-tag="0095" byte-length="4"/>

<tag-mapping type="response" xml-tag="for" imodem-tag="0096" byte-length="1"/>

<tag-mapping type="request" xml-tag="timestamp" imodem-tag="0097" byte-length="4"/>

<tag-mapping type="response" xml-tag="first-association-timestamp" imodem-tag="0098" byte-length="4"/>

<tag-mapping type="response" xml-tag="last-update-timestamp" imodem-tag="0099" byte-length="4"/>

<tag-mapping type="response" xml-tag="status" imodem-tag="009A" byte-length="2"/>

<tag-mapping type="common" xml-tag="device-info" imodem-tag="009B">

<tag-mapping type="response" xml-tag="num-devices" imodem-tag="009C" byte-length="1"/>

<tag-mapping type="request" xml-tag="device-num" imodem-tag="009D" byte-length="1"/>

<tag-mapping type="common" xml-tag="initiate-session" imodem-tag="0030"/>

<tag-mapping type="request" xml-tag="hub-id" imodem-tag="0031" byte-length="4"/>

<tag-mapping type="request" xml-tag="protocol-version" imodem-tag="0032" byte-length="2"/>

<tag-mapping type="response" xml-tag="update-flag" imodem-tag="0033" byte-length="1"/>

<tag-mapping type="response" xml-tag="key" imodem-tag="0034" byte-length="2"/>

<tag-mapping type="common" xml-tag="terminate-session" imodem-tag="0035"/>

<tag-mapping type="common" xml-tag="param-updates" imodem-tag="0036"/>

Chart Configuration File

[00199] This file contains the necessary information for formatting and displaying data charts. This information is kept in XML format neutral of the specific charting product so as to allow changeover to another charting application if necessary later. It does not currently have a DTD and therefore requires a non-validating parser. This file is stored on the server, not the client and is called chartconfig.xml

[00200] Please note the following: this format is an initial version and will likely be enhanced over time. The method for altering and enhancing chart display is to add tags and/or properties in the sections for each chart and use the values assigned to each to drive the behavior of the code. This is preferred over hard-coding the way a chart is displayed in the code itself.

[00201] In subsequent phases, this file may have an XSL transform applied to generate the product specific charting instructions e.g. if using Popchart, an XSLT would be provided to generate PCScript from this XML file.

```
<chart-config>
 <bp-chart>
  <type>TIMELINE</type>
  <title>Blood Pressure</title>
  <height>xxx</height>
  <width>yyy</width>
  <property name="appearance-file" value="URL of appearance file" />
  <property name="date-format" value="%m/%d/%y %H:%M" />
 </bp-chart>
 <hr-chart>
  <type>TIMESCATTER</type>
  <title>Heart Rate</title>
  <height>xxx</height>
  <width>yyy</width>
```

```
    <property name="appearance-file" value="URL of appearance file" />
    <property name="date-format" value="%m/%d/%y %H:%M" />
  </hr-chart>
  <temperature-chart>
    <type>TIMELINE</type>
    <title>Temperature</title>
    <height>xxx</height>
    <width>yyy</width>
    <property name="appearance-file" value="URL of appearance file" />
    <property name="date-format" value="%m/%d/%y %H:%M" />
  </temperature-chart>
  <weight-chart>
    <type>TIMELINE</type>
    <title>Blood Pressure</title>
    <height>xxx</height>
    <width>yyy</width>
    <property name="appearance-file" value="URL of appearance file" />
    <property name="date-format" value="%m/%d/%y %H:%M" />
  </weight-chart>
</chart-config>
```

[00202] Obviously, many modifications and variations of the present invention are possible in light of the above teachings. Thus, it is to be understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically described above.

[00203] What is claimed and desired to be covered by a Letters Patent is as follows:

Claims

What is claimed:

1. A patient monitoring system comprising:

a patient monitoring device which includes a physiological transducer for monitoring physiological characteristic data of a patient and a wireless communication system for transmitting said physiological characteristic data to a remote hub over a first wireless communication link;

the remote hub which includes a second communication system for receiving said physiological characteristic data over said first wireless communication link from said patient monitoring device and transmitting said physiological characteristic data to a remote server over a second communication link; and

the remote server, including a third communication system for receiving said physiological characteristic data over said second communication link, said remote server configured as a portal to selectively enable third party access to said physiological characteristic data.

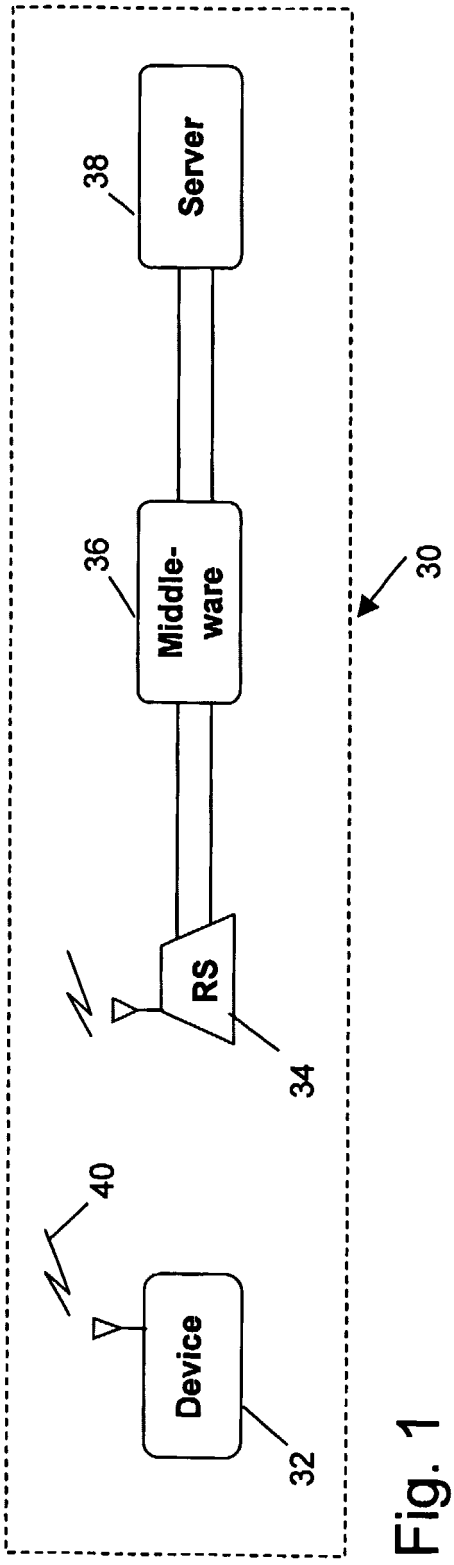

Fig. 1

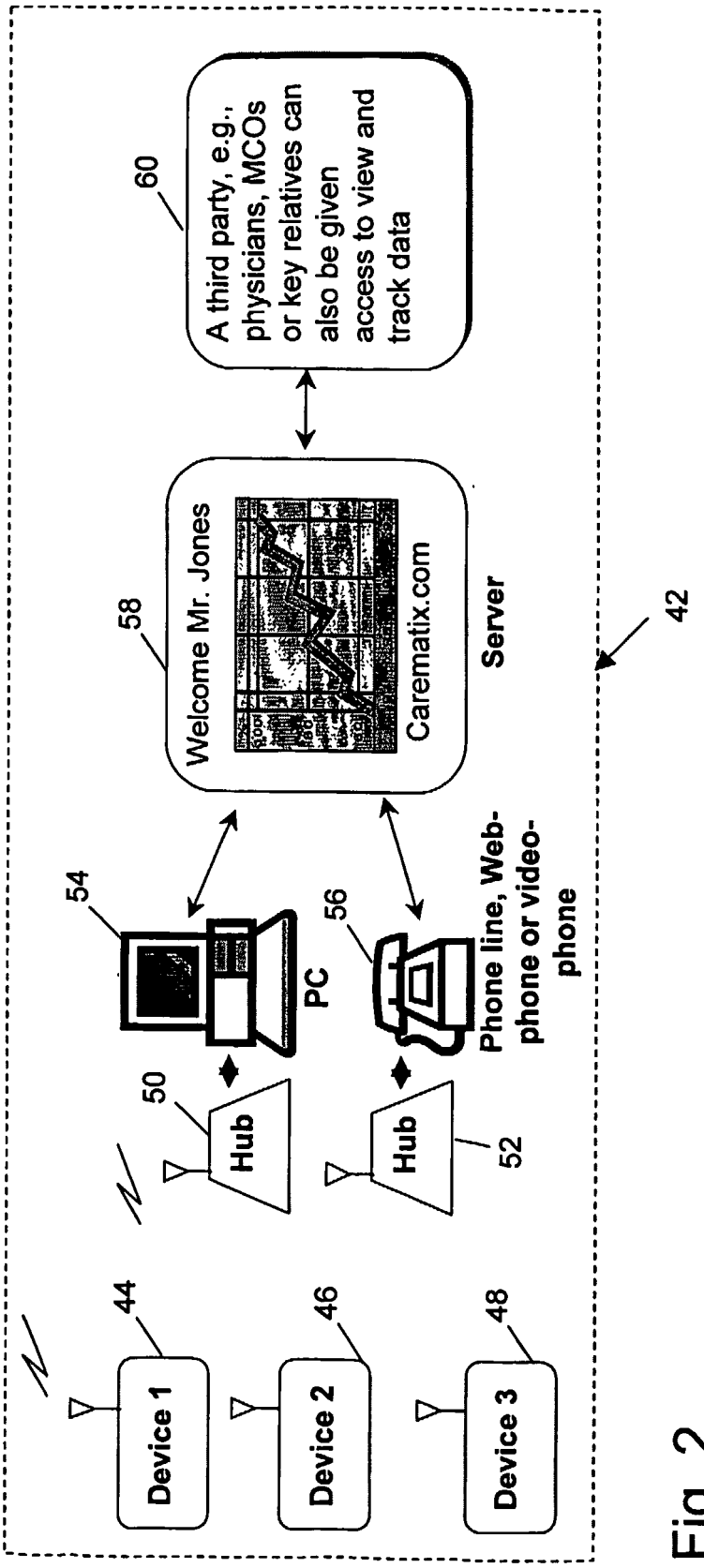
A third party, e.g., physicians, MCOs or key relatives can also be given access to view and track data
60
Welcome Mr. Jones
Carematix.com
Server
58
42
54
PC
56
Phone line, Web-phone or video-phone
50
Hub
Hub
52
44
46
48
Device 1
Device 2
Device 3

Fig. 2

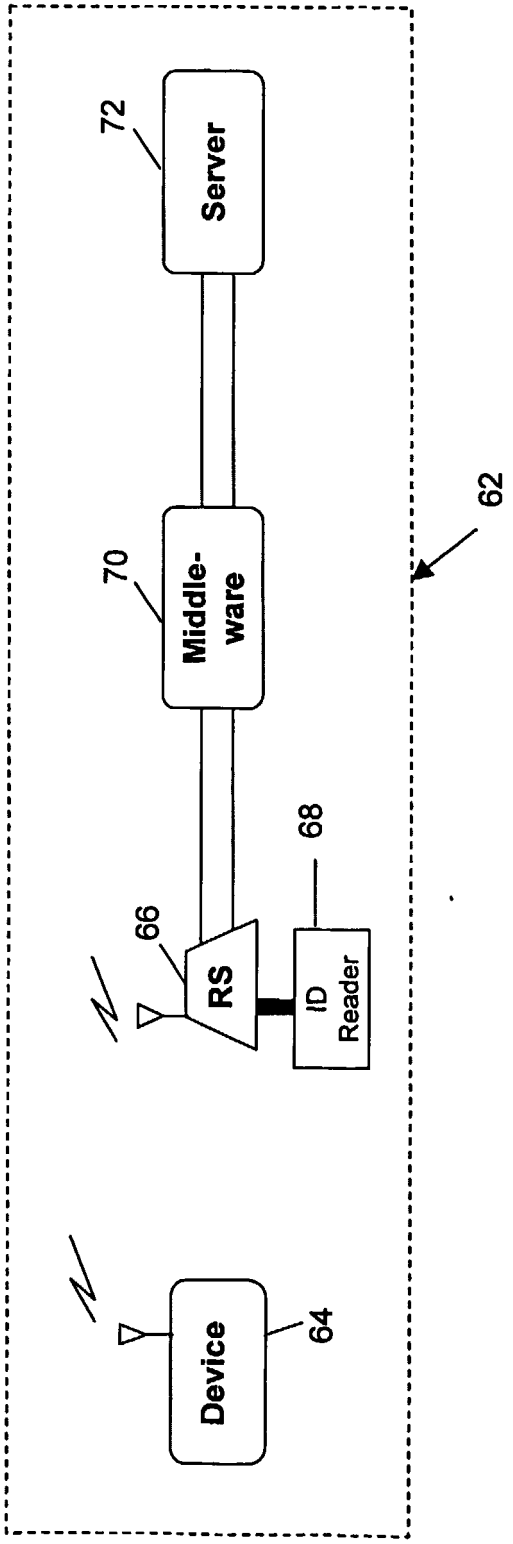

Fig. 3

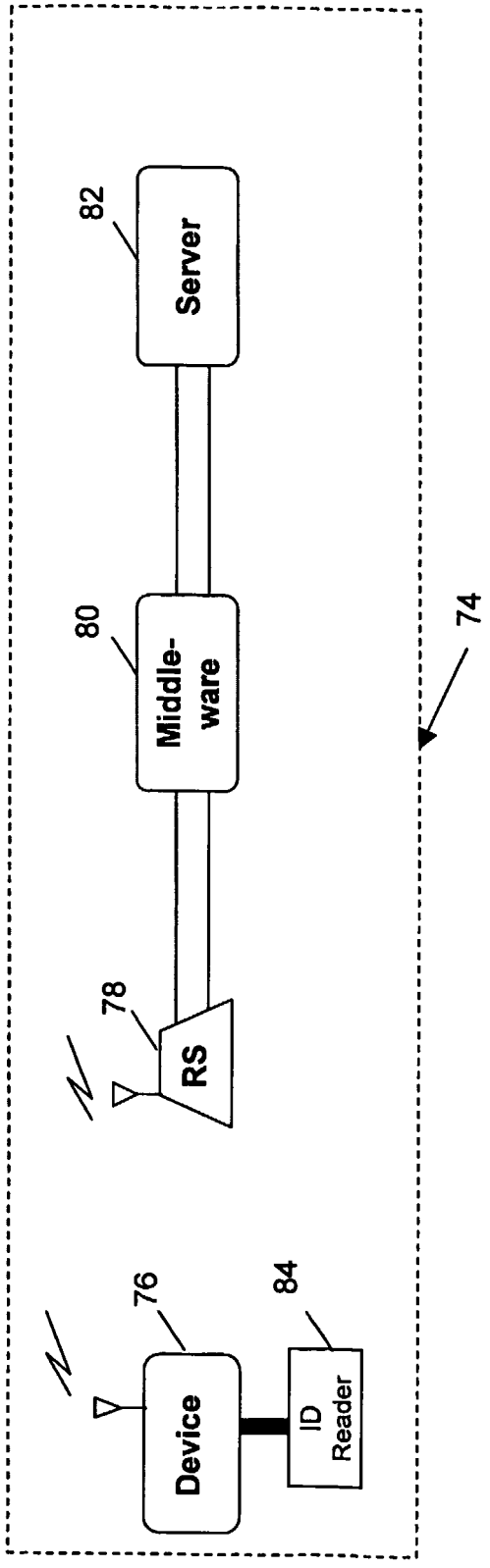

Fig. 4

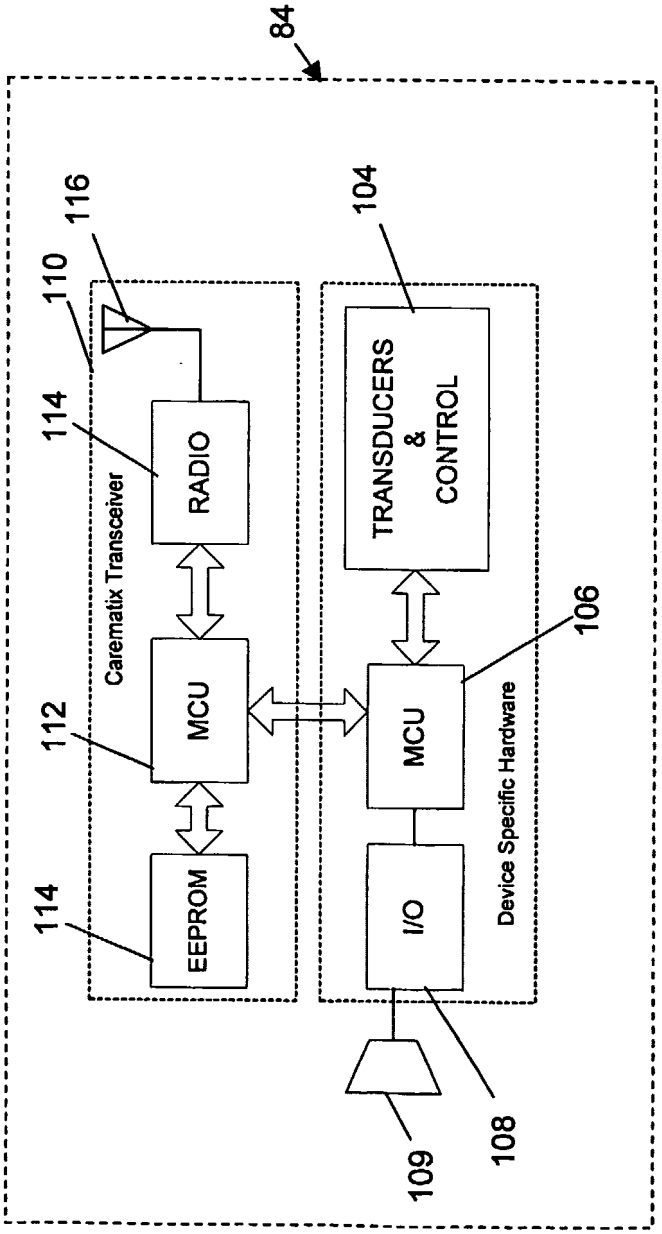
84
116
110
114
RADIO
Carematix Transceiver
112
MCU
114
EEPROM
104
TRANSDUCERS
&
CONTROL
106
MCU
I/O
Device Specific Hardware
109
108

Fig. 5

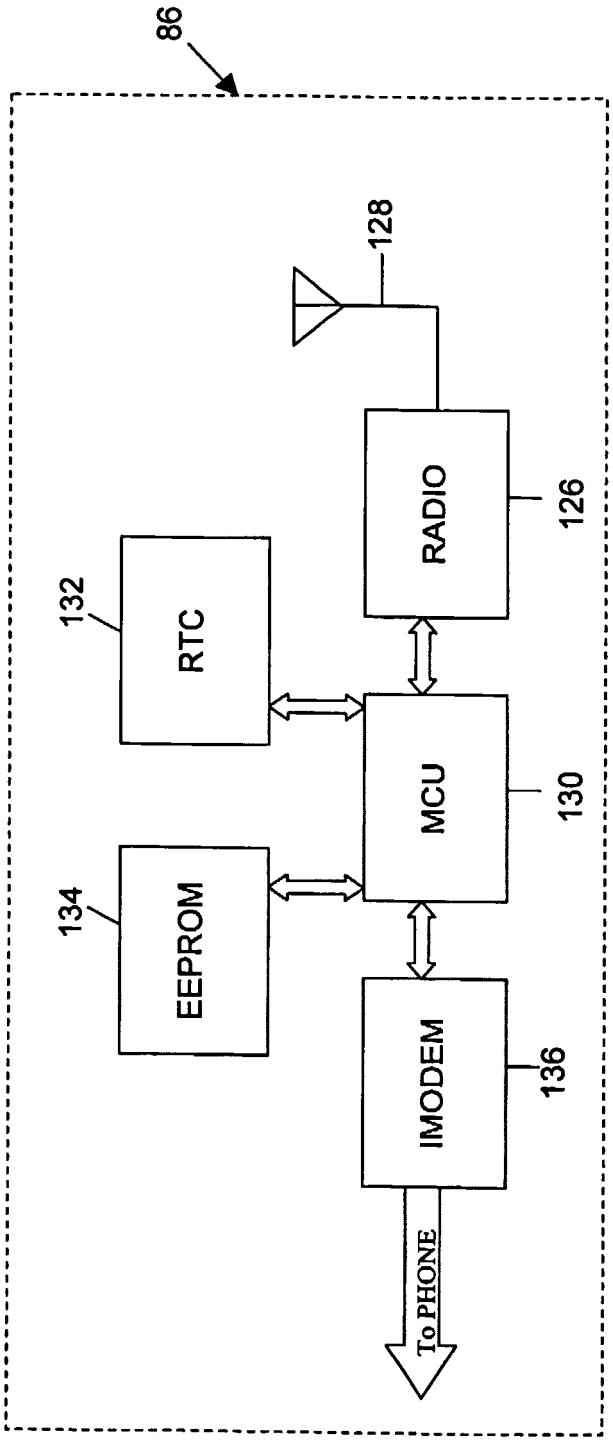
86
128
RADIO
126
132
RTC
MCU
130
134
EEPROM
IMODEM
136
To PHONE

Fig. 6

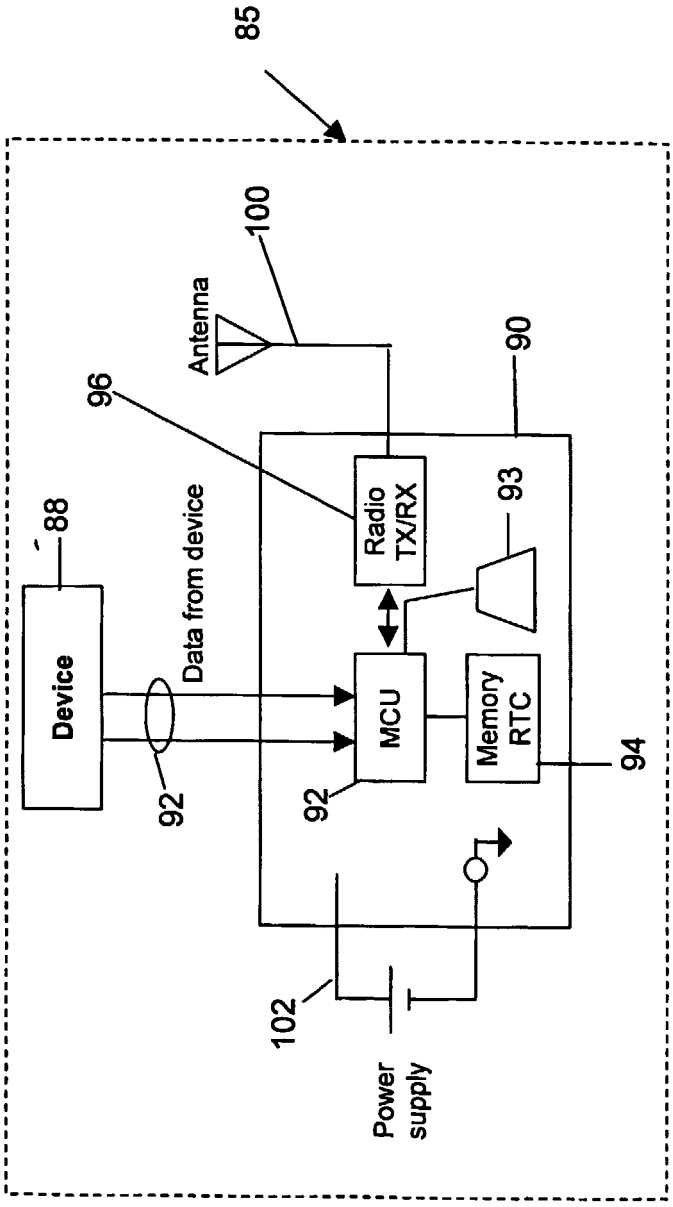
85
100
Antenna
90
96
Radio TX/RX
93
88
Device
Data from device
MCU
Memory RTC
94
92
92
102
Power supply

Fig. 7

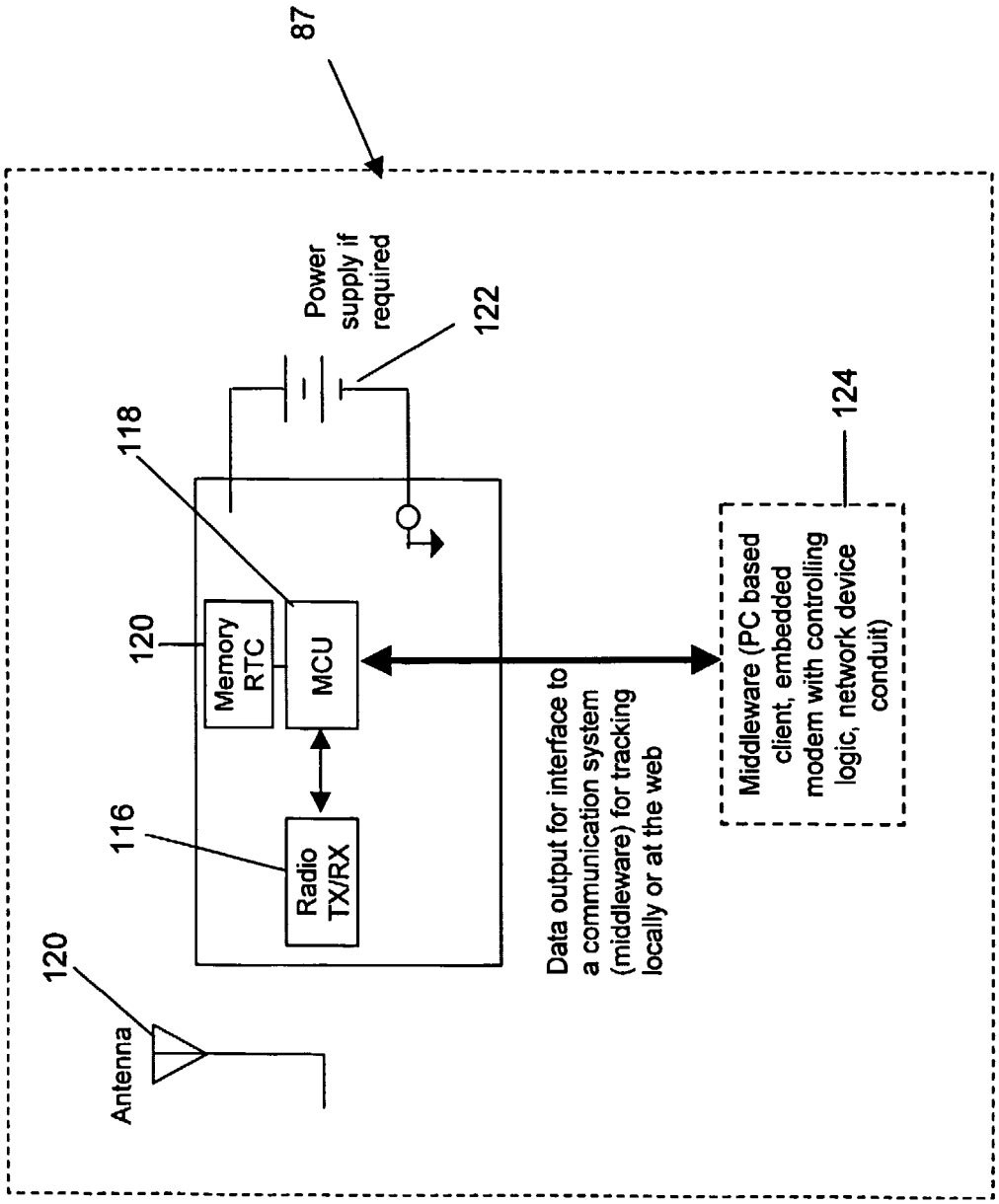
87
Power supply if required
122
118
120
Memory RTC
MCU
116
Radio TX/RX
120
Antenna
Data output for interface to a communication system (middleware) for tracking locally or at the web
124
Middleware (PC based client, embedded modem with controlling logic, network device conduit)

Fig. 8

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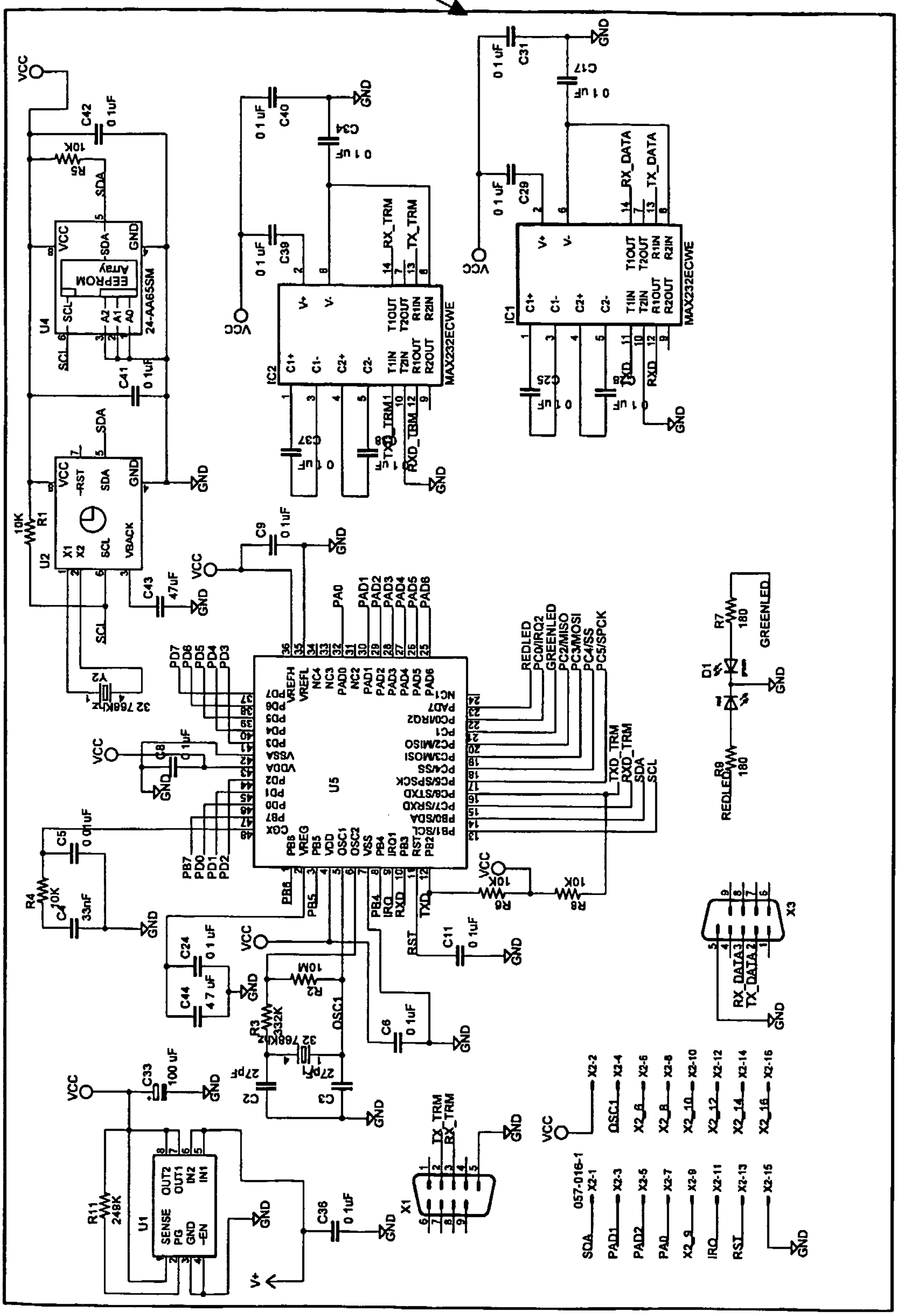
86



VCC
GND
C42
0.1uF
R5
10K
SDA
SCL
U4
24-AA65SM
EEPROM Array
U2
VBACK
R1
C41
C43
47uF
Y2
32.768KHz
C40
C34
C39
IC2
MAX232ECWE
RX_TRM
TX_TRM
TXD_TRM1
RXD_TRM
C37
C38
C31
C17
C29
IC1
RX_DATA
TX_DATA
C25
TXD
RXD
C9
U5
PA0
PAD1
PAD2
PAD3
PAD4
PAD5
PAD6
REDLED
PC0/IRQ2
GREENLED
PC2/MISO
PC3/MOSI
PC4/SS
PC5/SPCK
PD7
PD6
PD5
PD4
PD3
PB7
PD0
PD1
PD2
C8
C5
R4
C4
33nF
C24
C44
R2
10M
R3
332K
OSC1
C2
C3
27pF
C6
C11
R6
R8
10K
RST
IRQ
PB4
PB5
PB6
C33
100 uF
U1
R11
248K
SENSE
PG
-EN
OUT2
OUT1
IN2
IN1
C36
V+
X1
X2
X3
RX_DATA3
TX_DATA2
D1
R7
R9
180
057-016-1

Fig. 9A

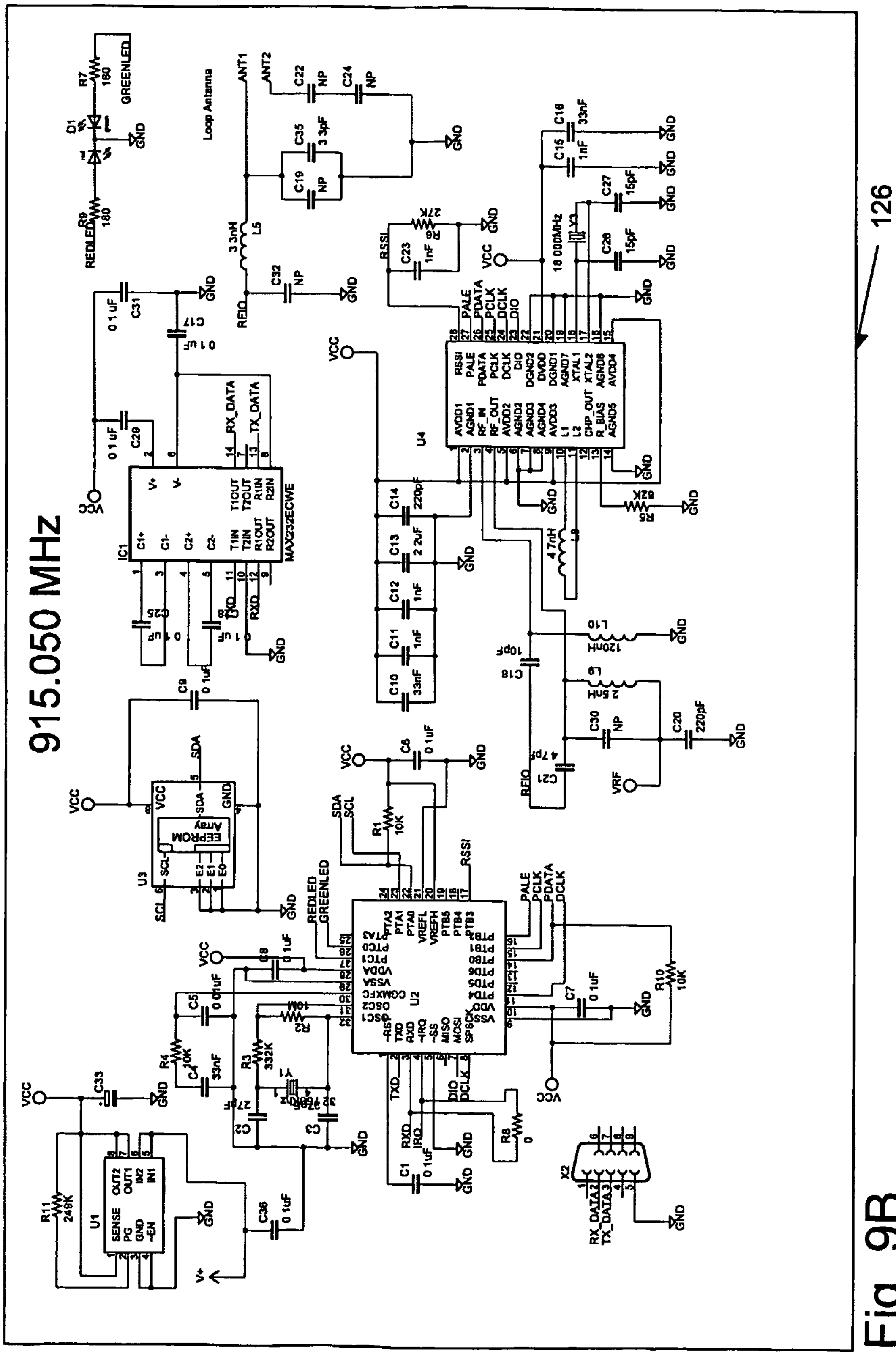

915.050 MHz
126
Loop Antenna
MAX232ECWE
EEPROM Array
REDLED
GREENLED
RX_DATA
TX_DATA

Fig. 9B

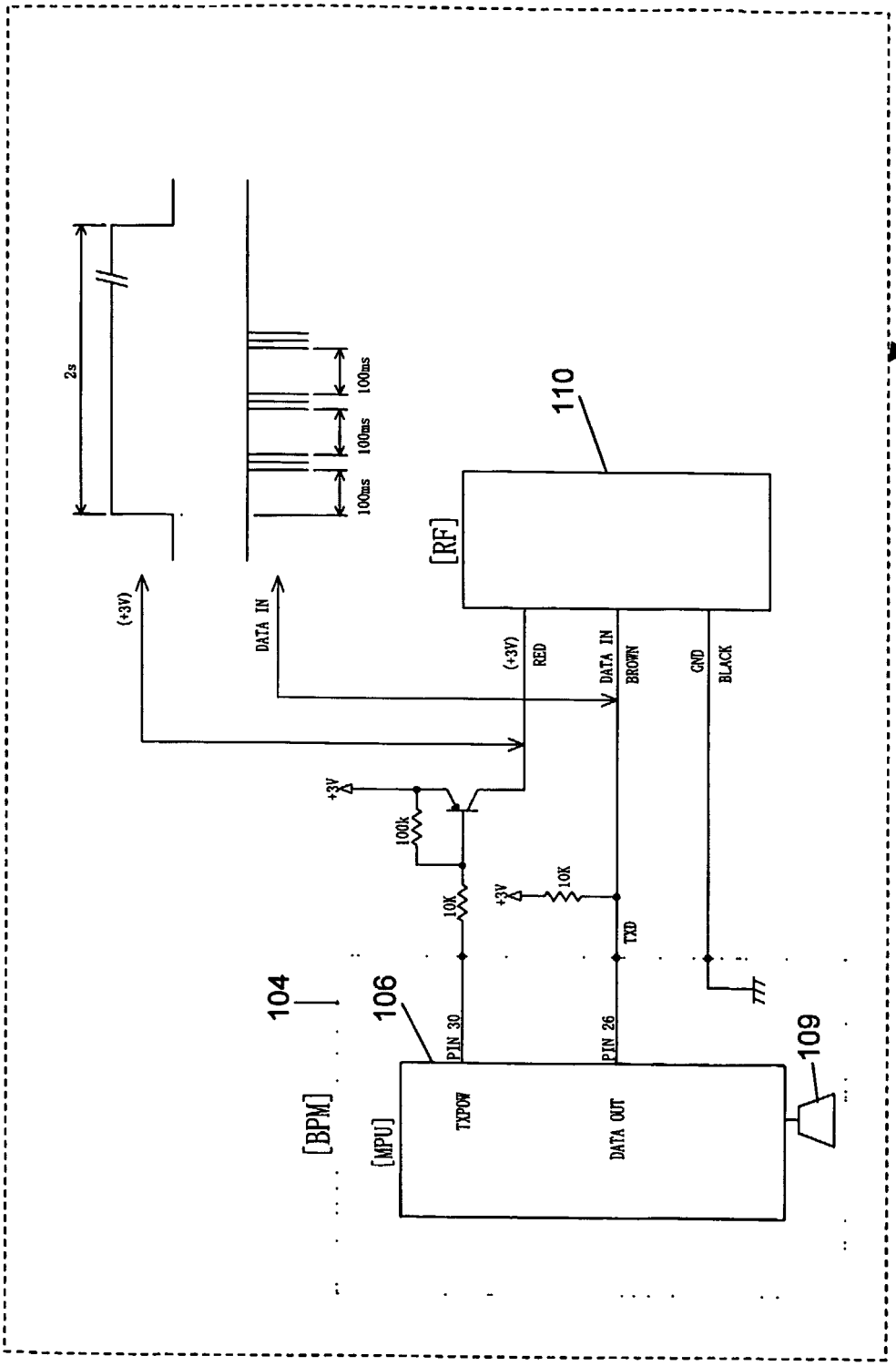

84
110
[RF]
(+3V)
DATA IN
RED
BROWN
BLACK
GND
2s
100ms
100ms
100ms
+3V
100K
10K
10K
+3V
TXD
104
106
PIN 30
PIN 26
109
[BPM]
[MPU]
TXPOW
DATA OUT

Fig. 10

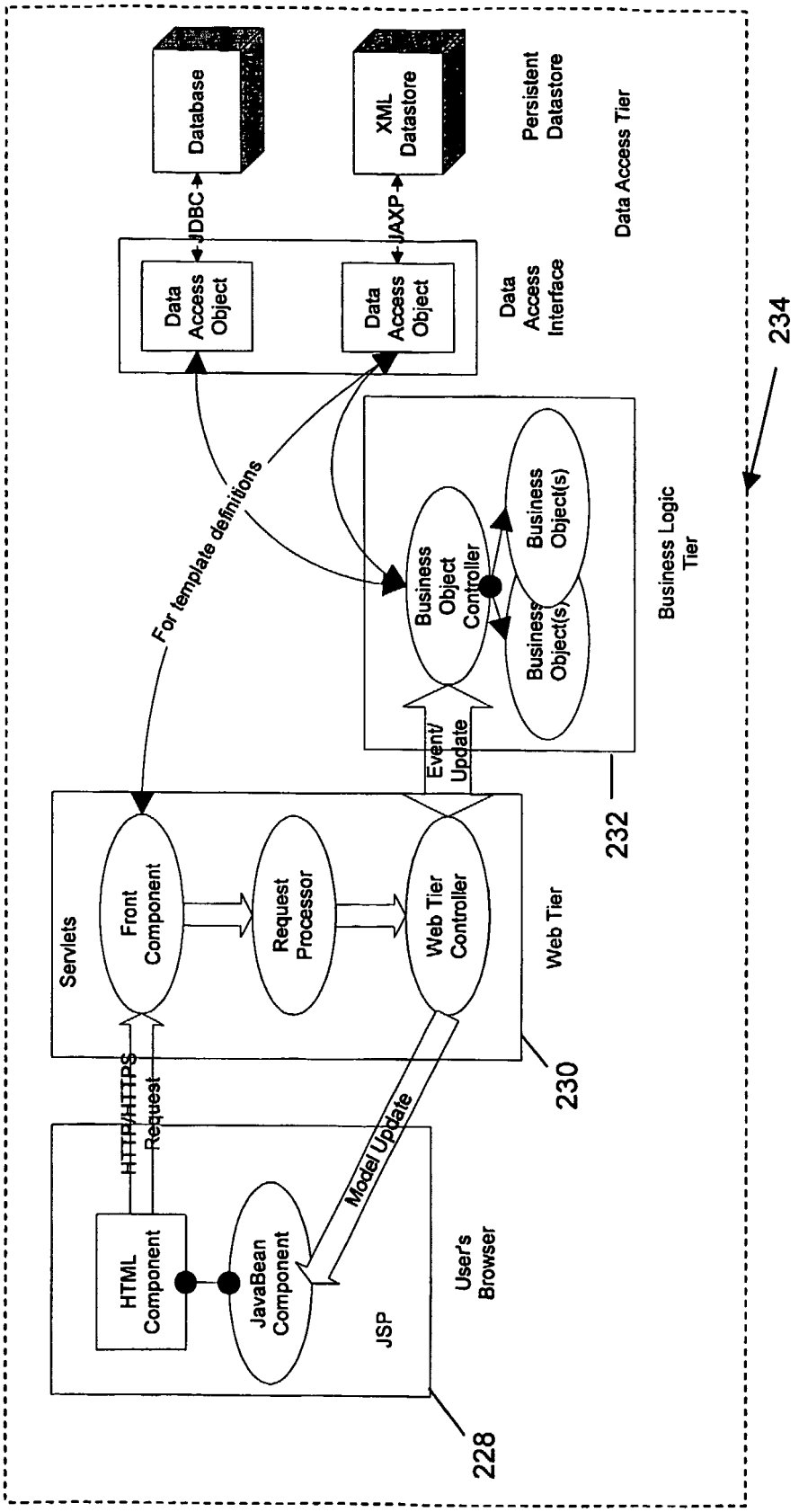

Database
XML Datastore
Persistent Datastore
JDBC
JAXP
Data Access Object
Data Access Object
Data Access Interface
Data Access Tier
234
For template definitions
Business Object Controller
Business Object(s)
Business Object(s)
Business Logic Tier
Event/ Update
232
Servlets
Front Component
Request Processor
Web Tier Controller
Web Tier
HTTP/HTTPS Request
230
Model Update
HTML Component
JavaBean Component
JSP
User's Browser
228

Fig. 11

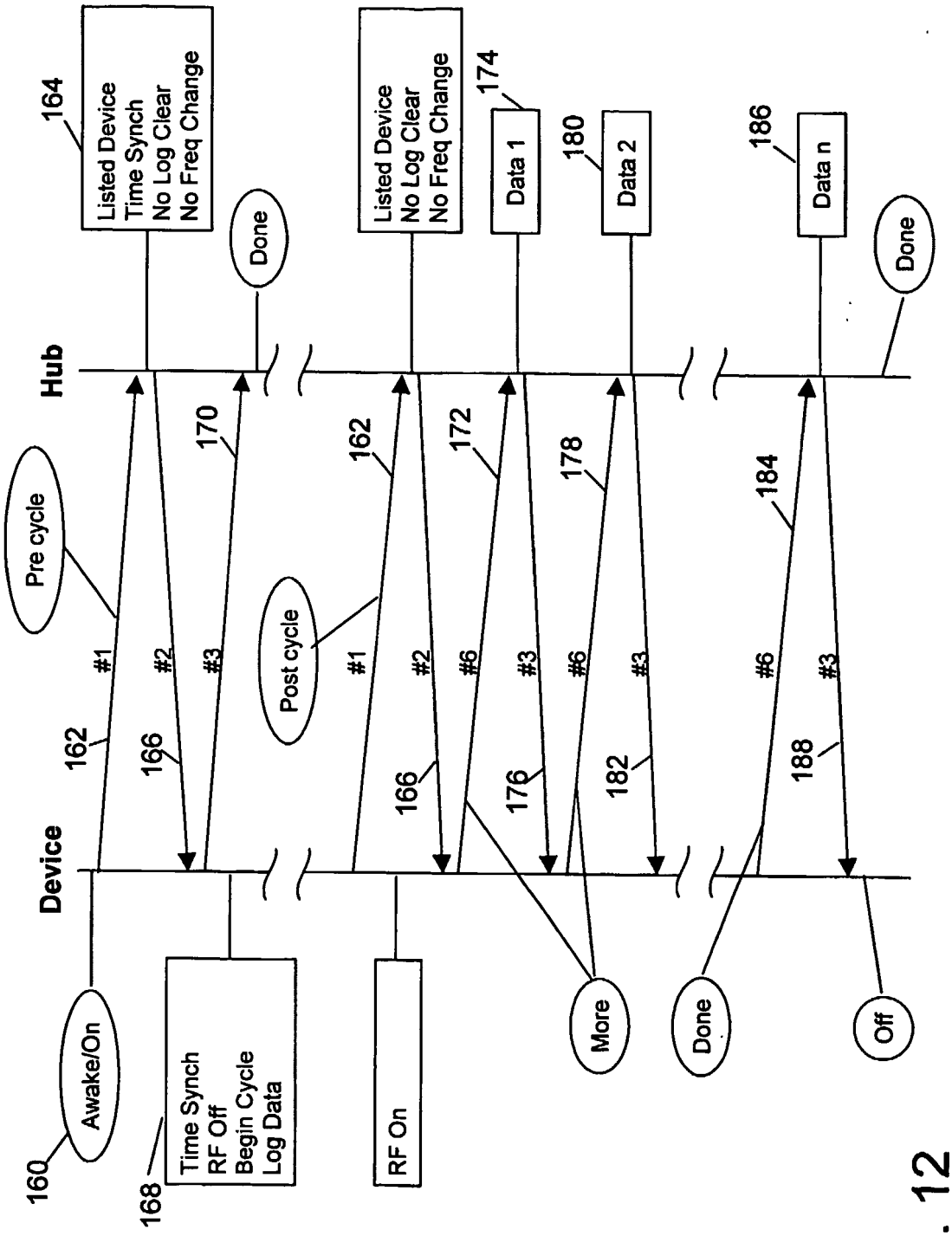

Hub
Device
Pre cycle
Post cycle
Awake/On
Time Synch
RF Off
Begin Cycle
Log Data
RF On
More
Done
Off
Listed Device
Time Synch
No Log Clear
No Freq Change
Listed Device
No Log Clear
No Freq Change
Data 1
Data 2
Data n
Done
Done
#1
#2
#3
#1
#2
#6
#3
#6
#3
#6
#3
160
162
164
166
168
170
172
174
176
178
180
182
184
186
188

Fig. 12

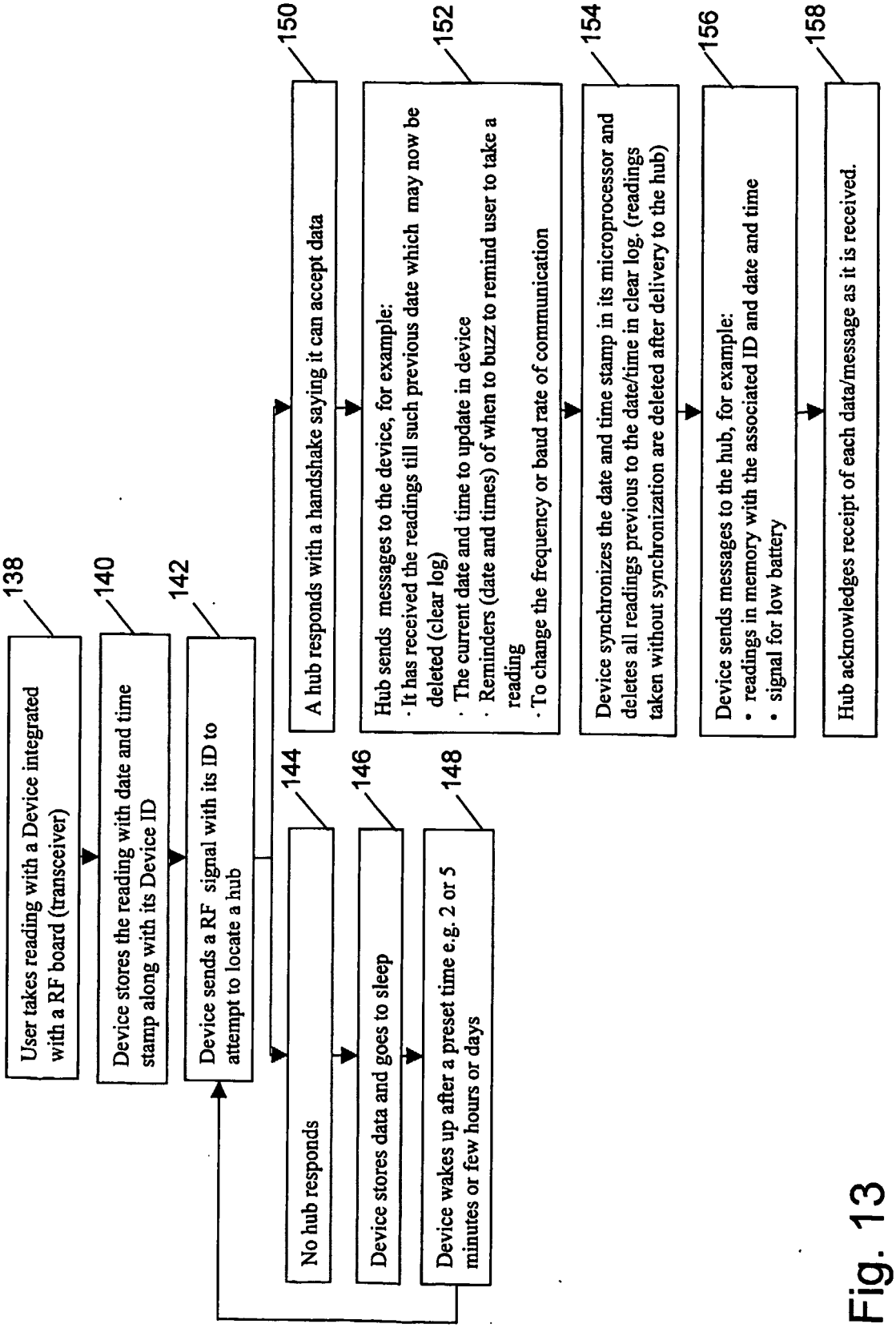

138
User takes reading with a Device integrated with a RF board (transceiver)
140
Device stores the reading with date and time stamp along with its Device ID
142
Device sends a RF signal with its ID to attempt to locate a hub
144
No hub responds
146
Device stores data and goes to sleep
148
Device wakes up after a preset time e.g. 2 or 5 minutes or few hours or days
150
A hub responds with a handshake saying it can accept data
152
Hub sends messages to the device, for example:
· It has received the readings till such previous date which may now be deleted (clear log)
· The current date and time to update in device
· Reminders (date and times) of when to buzz to remind user to take a reading
· To change the frequency or baud rate of communication
154
Device synchronizes the date and time stamp in its microprocessor and deletes all readings previous to the date/time in clear log. (readings taken without synchronization are deleted after delivery to the hub)
156
Device sends messages to the hub, for example:
• readings in memory with the associated ID and date and time
• signal for low battery
158
Hub acknowledges receipt of each data/message as it is received.

Fig. 13

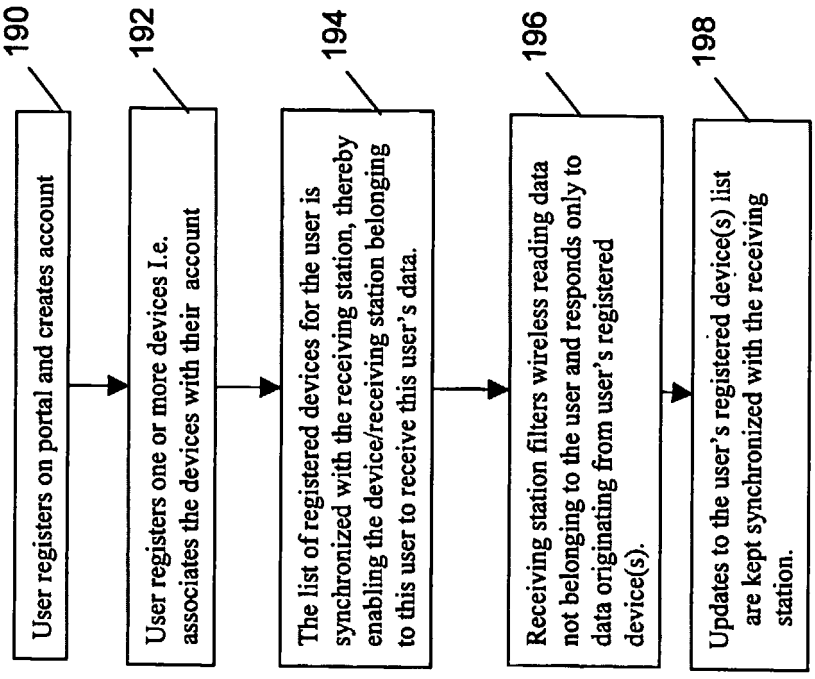

190
User registers on portal and creates account
192
User registers one or more devices I.e. associates the devices with their account
194
The list of registered devices for the user is synchronized with the receiving station, thereby enabling the device/receiving station belonging to this user to receive this user's data.
196
Receiving station filters wireless reading data not belonging to the user and responds only to data originating from user's registered device(s).
198
Updates to the user's registered device(s) list are kept synchronized with the receiving station.

Fig. 14

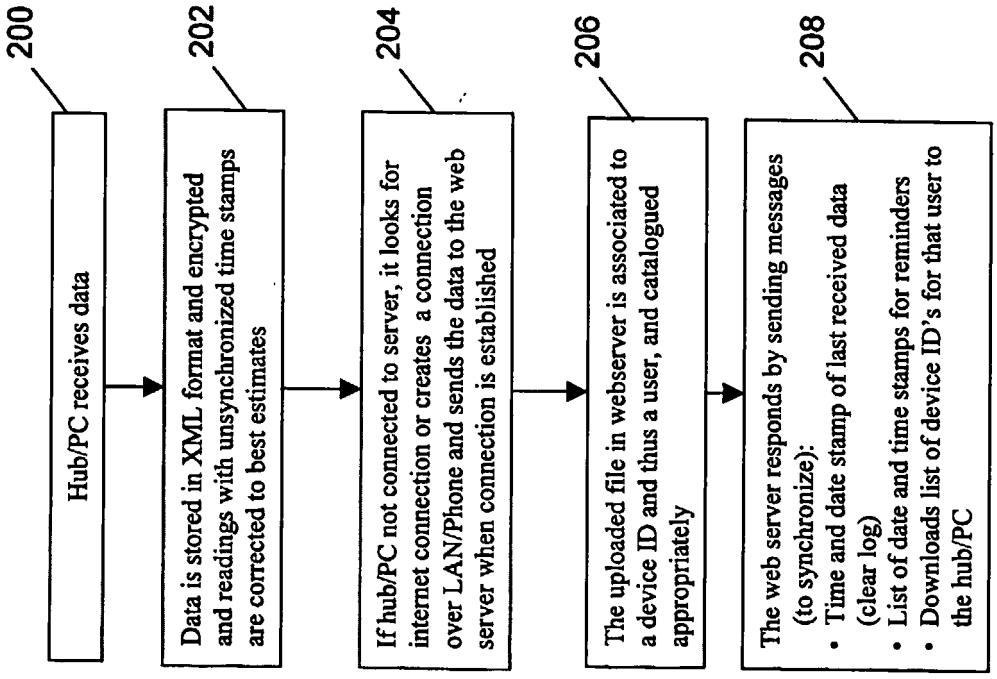

200
Hub/PC receives data
202
Data is stored in XML format and encrypted and readings with unsynchronized time stamps are corrected to best estimates
204
If hub/PC not connected to server, it looks for internet connection or creates a connection over LAN/Phone and sends the data to the web server when connection is established
206
The uploaded file in webserver is associated to a device ID and thus a user, and catalogued appropriately
208
The web server responds by sending messages (to synchronize):
• Time and date stamp of last received data (clear log)
• List of date and time stamps for reminders
• Downloads list of device ID's for that user to the hub/PC

Fig. 15

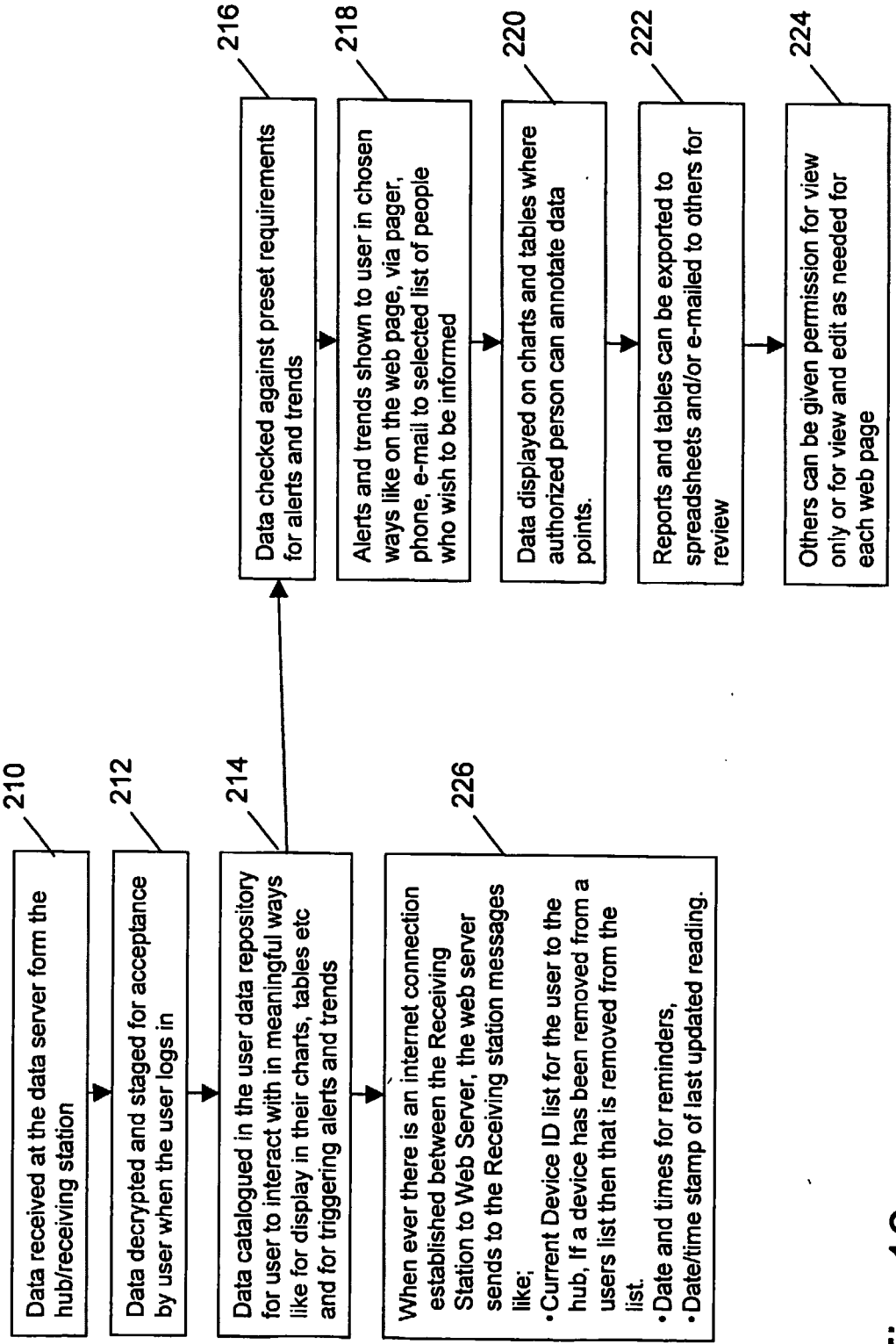

210
Data received at the data server form the hub/receiving station
212
Data decrypted and staged for acceptance by user when the user logs in
214
Data catalogued in the user data repository for user to interact with in meaningful ways like for display in their charts, tables etc and for triggering alerts and trends
216
Data checked against preset requirements for alerts and trends
218
Alerts and trends shown to user in chosen ways like on the web page, via pager, phone, e-mail to selected list of people who wish to be informed
220
Data displayed on charts and tables where authorized person can annotate data points.
222
Reports and tables can be exported to spreadsheets and/or e-mailed to others for review
224
Others can be given permission for view only or for view and edit as needed for each web page
226
When ever there is an internet connection established between the Receiving Station to Web Server, the web server sends to the Receiving station messages like;
•Current Device ID list for the user to the hub, If a device has been removed from a users list then that is removed from the list.
•Date and times for reminders,
•Date/time stamp of last updated reading.

Fig. 16

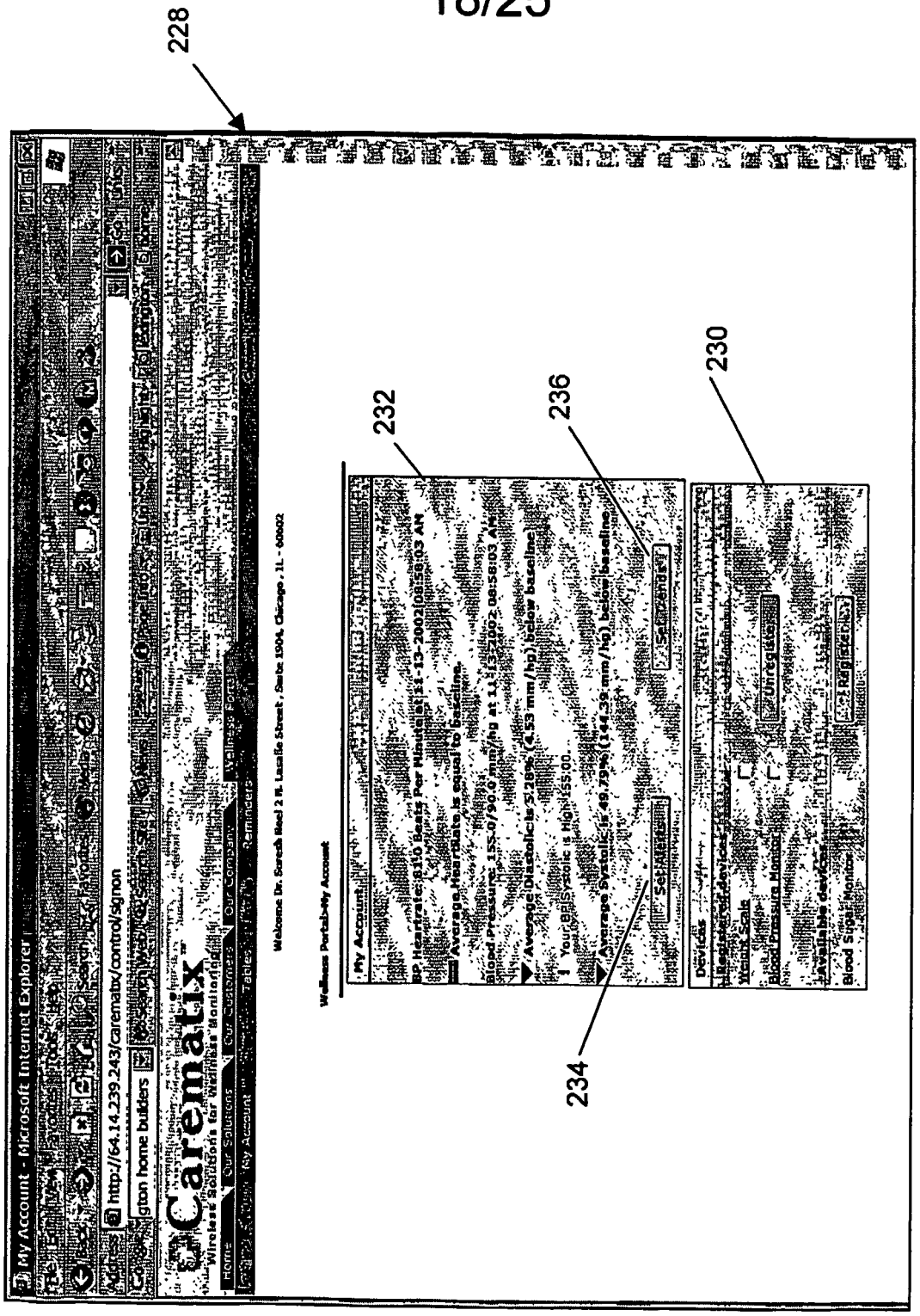

228
232
236
230
234
My Account - Microsoft Internet Explorer
http://64.14.239.243/carematrix/control/sgmon
eCarematrix
Wireless Solutions for Wellness
Home
Our Solutions
Our Customers
Wellness Portal
Reminders
My Account
Welcome Dr. Scratch Real 2 FL Lasalle Street, Suite 1904, Chicago , IL - 60602
Wellness Portal-My Account
My Account
BP, Heartrate: 8:10 Beats Per Minute 11-13-2002 08:58:03 AM
Average Heartrate is equal to baseline.
Blood Pressure: 155.0/90.0 mm/hg at 11-13-2002 08:58:03 AM
Average Diastolic is 2.8% (4.53 mm/hg) above baseline
Your Systolic is 0.0% (144.39 mm/hg) below baseline
Set Reminders
Set Milestones
devices
Registered devices
Weight Scale
Blood Pressure Monitor
Unregister
Available devices
Blood Sugar Monitor
Register

Fig. 17

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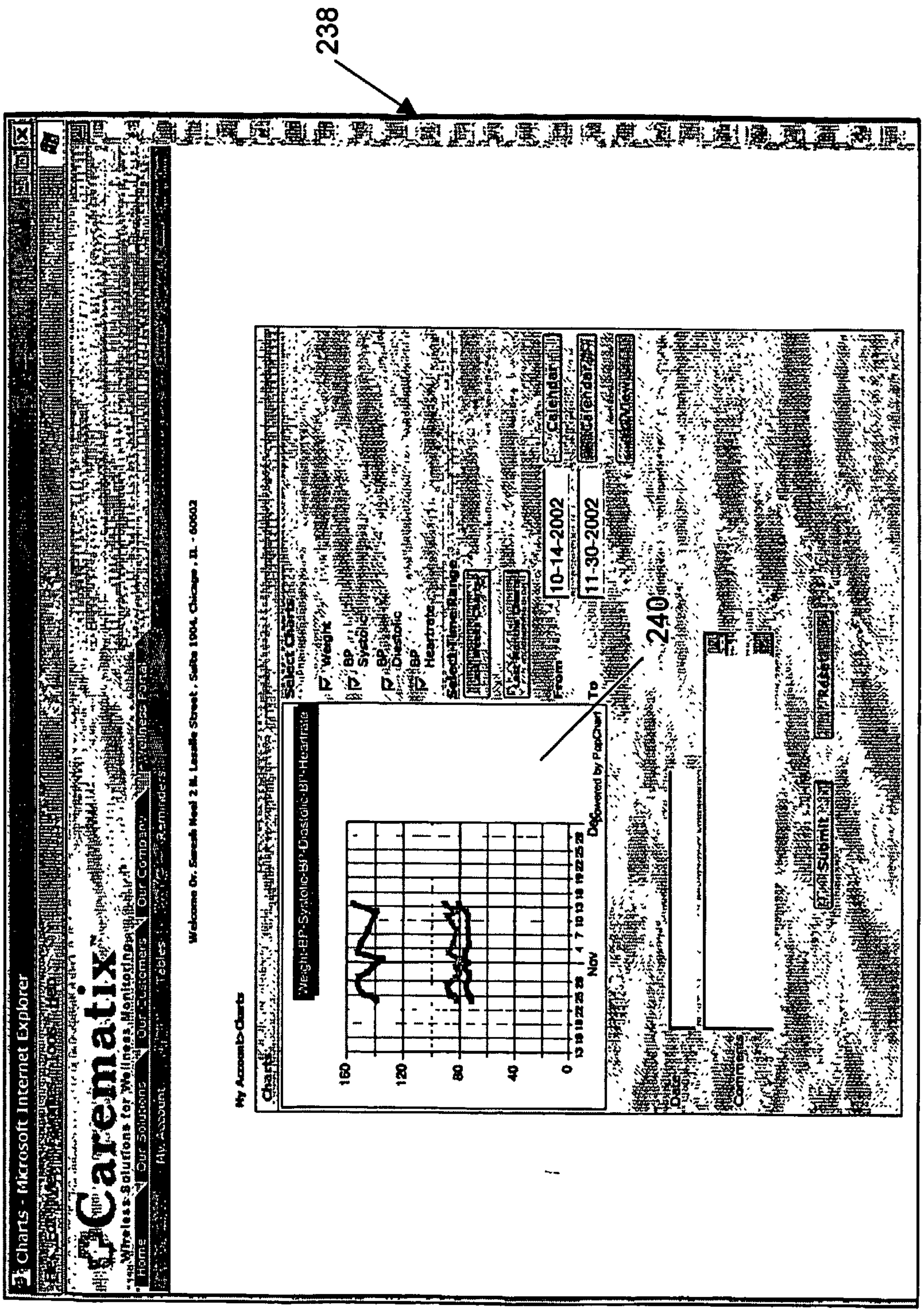
238
240
Charts - Microsoft Internet Explorer
Carematix
Wireless Solutions for Wellness Monitoring
Home
Our Solutions
Our Customers
Our Company
Wellness Portal
My Account
Tables
Reminders
My Account>Charts
Charts
Weight-BP-Systolic-BP-Diastolic-BP-Heartrate
160
120
80
40
0
Nov
Dec
Powered by PopChart
Select Charts
Weight
BP Systolic
BP Diastolic
BP Heartrate
Select Time Range
From
10-14-2002
To
11-30-2002
Calendar
Date
Comments
Submit

Fig. 18

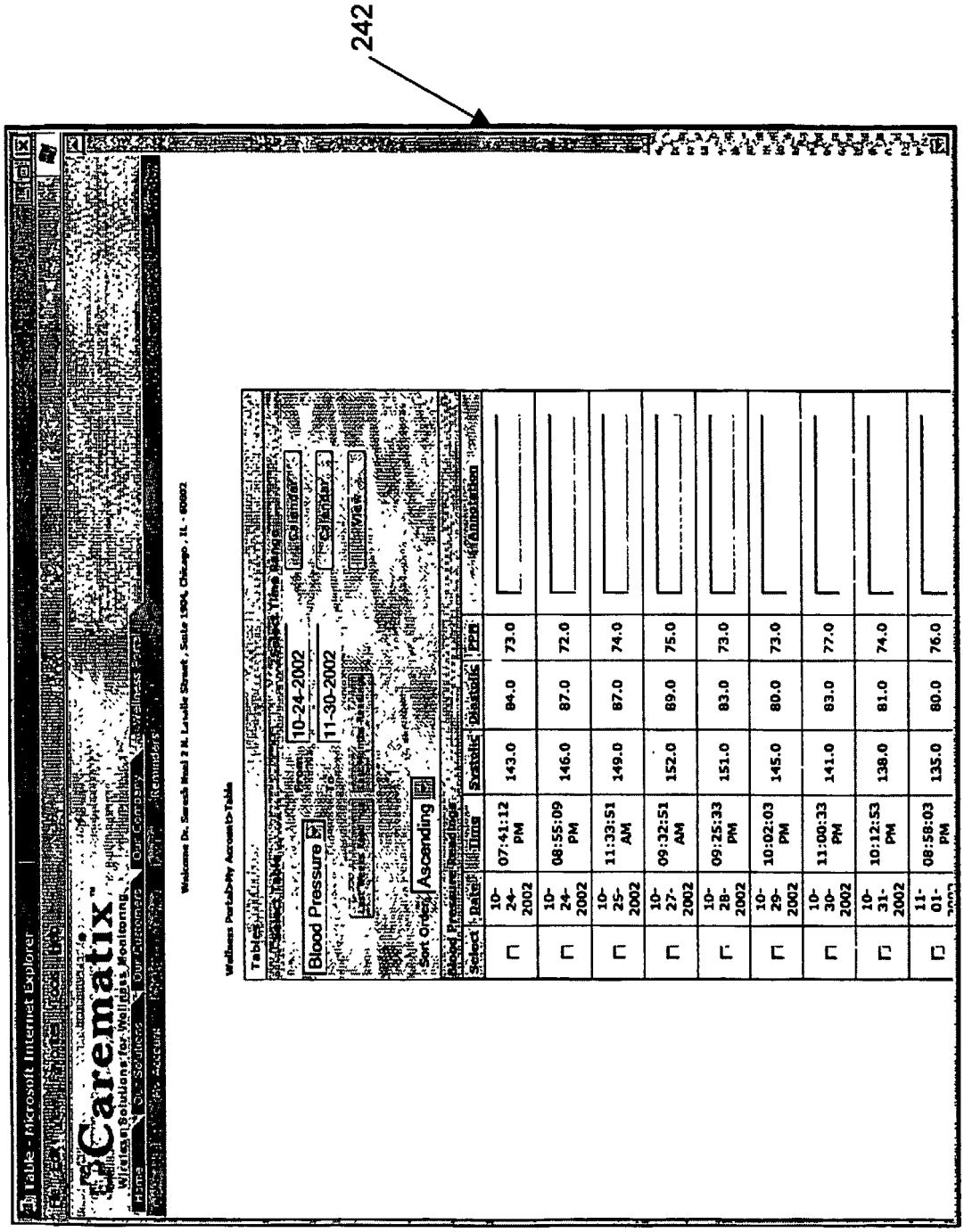
242
Table - Microsoft Internet Explorer
eCarematix
Blood Pressure
10-24-2002
11-30-2002
Ascending
Select
Date
Time
Systolic
Diastolic
Pulse
10-24-2002 07:41:12 PM 143.0 84.0 73.0
10-24-2002 08:55:09 PM 146.0 87.0 72.0
10-25-2002 11:33:51 AM 149.0 87.0 74.0
10-27-2002 09:32:51 AM 152.0 89.0 75.0
10-28-2002 09:25:33 PM 151.0 83.0 73.0
10-29-2002 10:02:03 PM 145.0 80.0 73.0
10-30-2002 11:00:33 PM 141.0 83.0 77.0
10-31-2002 10:12:53 PM 138.0 81.0 74.0
11-01-2002 08:58:03 PM 135.0 80.0 76.0

Fig. 19

21/25

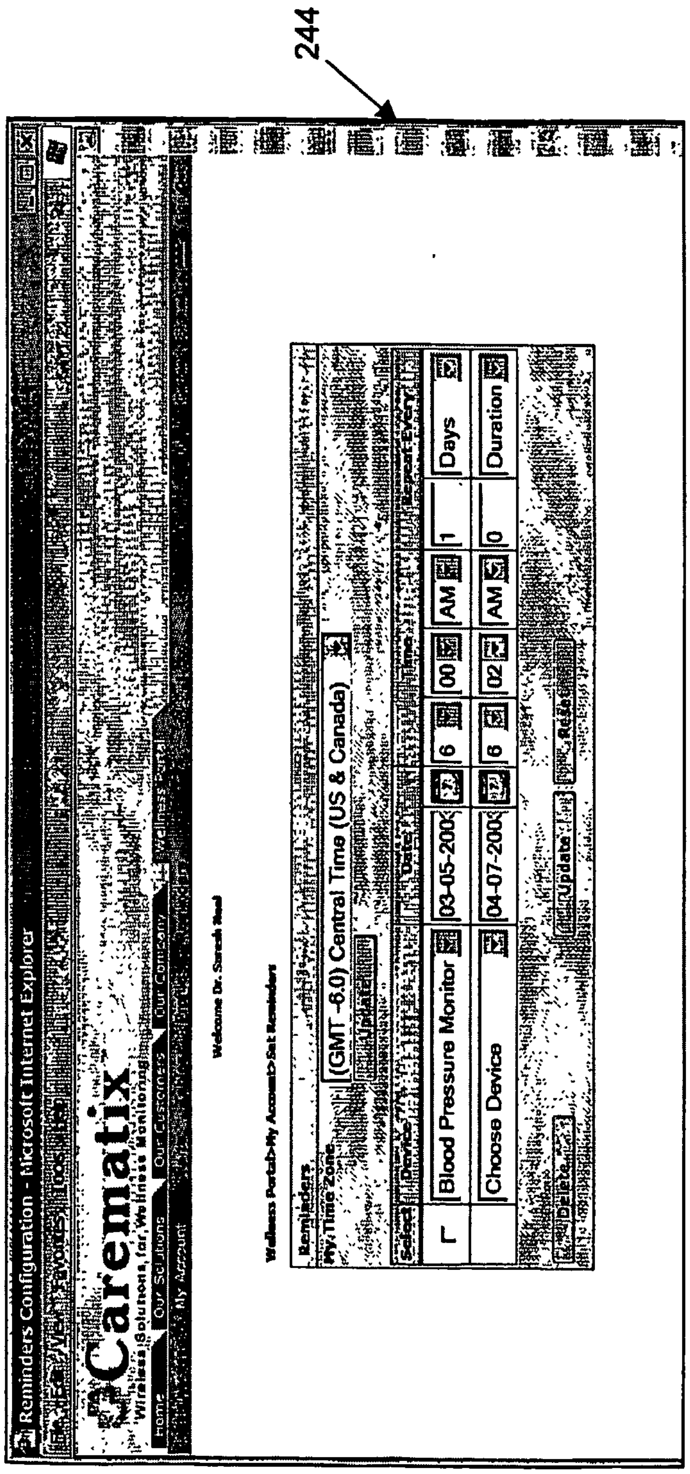
244
Reminders Configuration - Microsoft Internet Explorer
Carematix
Wireless Solutions for Wellness Monitoring
Home
Our Solutions
Our Customers
Our Company
Wellness Portal
My Account
Wellness Portal>My Account>Set Reminders
Reminders
My Time Zone
(GMT -6.0) Central Time (US & Canada)
Select
Device
Date
Time
Repeat Every
Blood Pressure Monitor
03-05-200
6
00
AM
1
Days
Choose Device
04-07-200
6
02
AM
0
Duration
Delete
Update
Reset

Fig. 20

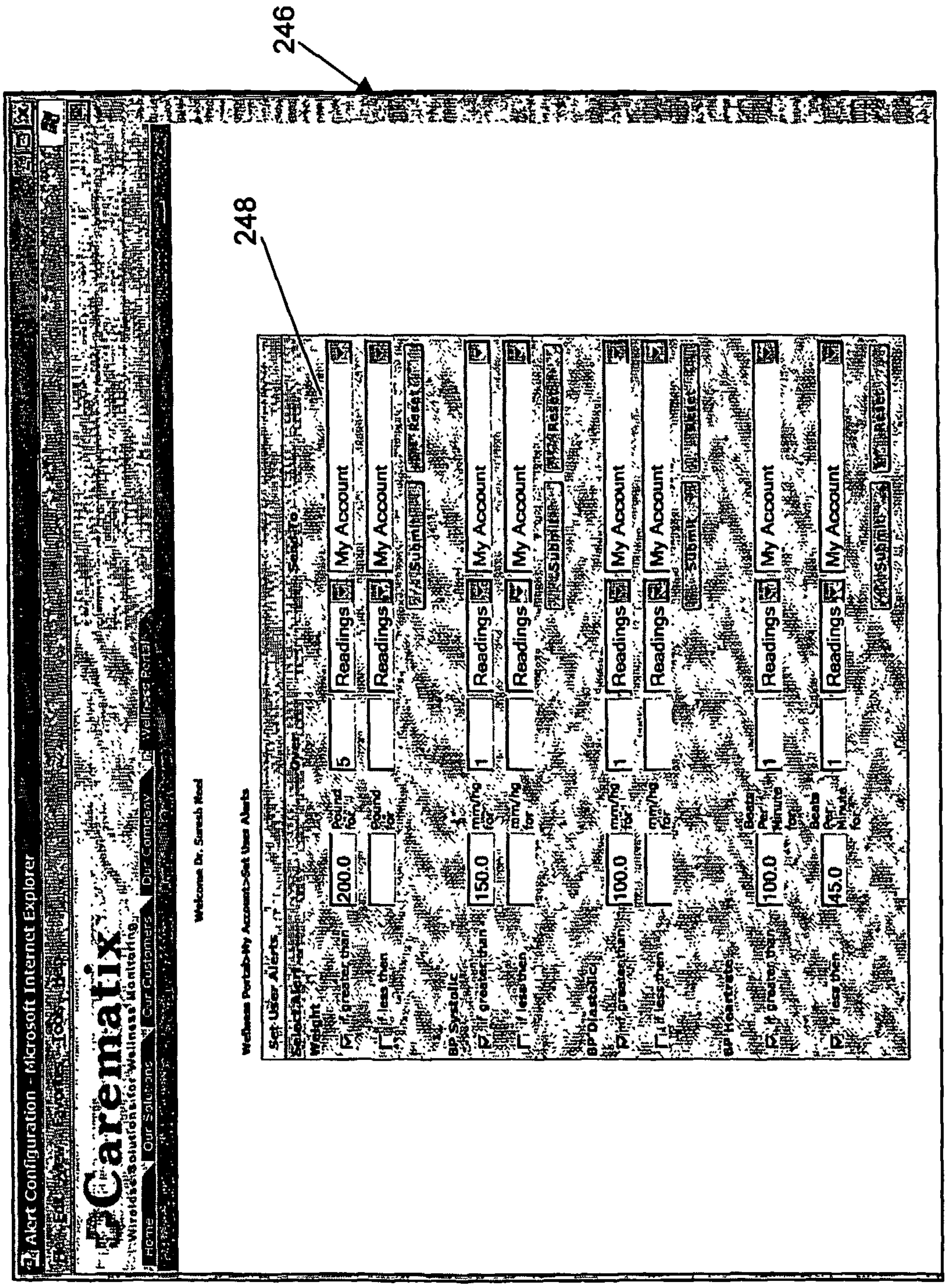
246
248
Alert Configuration - Microsoft Internet Explorer
Carematix
Wireless Solutions for Wellness Monitoring
Home
Our Solutions
Our Customers
Our Company
Wellness Portal
Welcome Dr. Suresh Nad
Wellness Portal>My Account>Set User Alerts
Set User Alerts
Weight
BP Systolic
BP Diastolic
BP Heartrate
200.0
150.0
100.0
100.0
45.0
5
1
1
1
1
Readings
Readings
Readings
Readings
Readings
Readings
Readings
Readings
My Account
My Account
My Account
My Account
My Account
My Account
My Account
My Account

Fig. 21

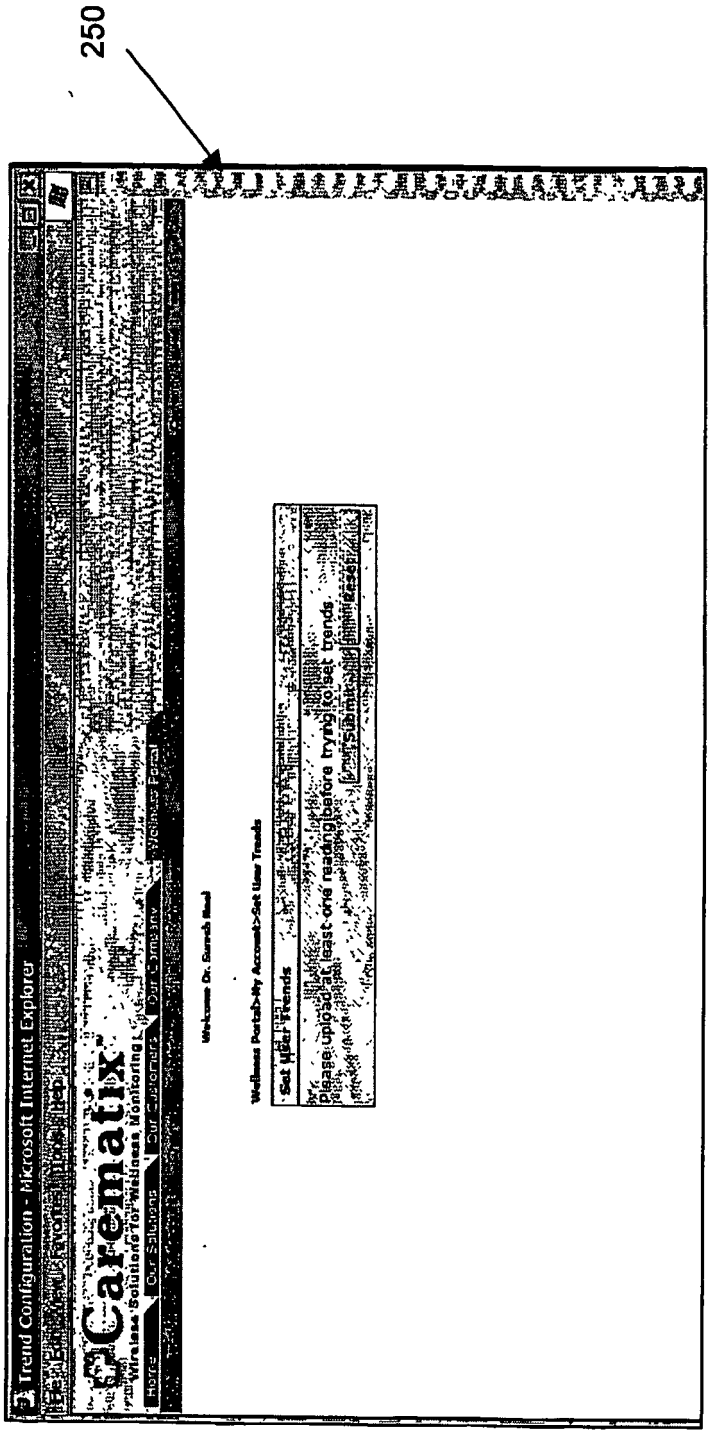
250
Trend Configuration - Microsoft Internet Explorer
eCarematix
Home
Our Solutions
Our Customers
Our Company
Wellness Portal
Welcome Dr. Ranesh Raul
Wellness Portal>My Account>Set User Trends
Set User Trends
Please upload at least one reading before trying to set trends.

Fig. 22

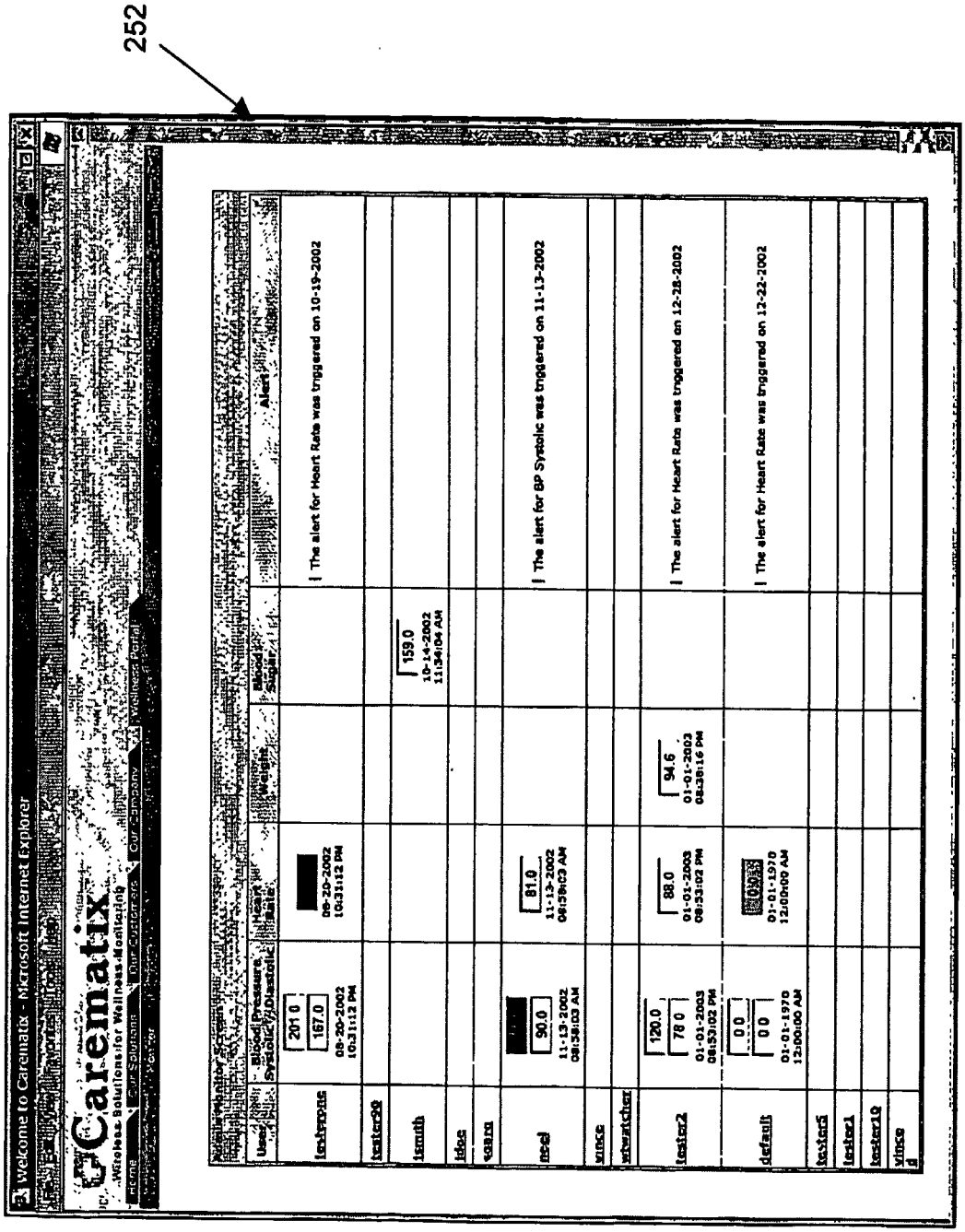
252
Welcome to Carematix - Microsoft Internet Explorer
Carematix
Wireless Solutions for Wellness Monitoring
Home
Our Solutions
Our Company
Our Customers
Wellness Portal
Alerts
Blood Pressure Systolic/Diastolic
Heart Rate
Weight
Blood Sugar
lashropas
201.0
167.0
08-20-2002 10:31:12 PM
08-20-2002 10:31:12 PM
The alert for Heart Rate was triggered on 10-19-2002
testers99
lsmith
159.0
10-14-2002 11:54:04 AM
idas
cesra
neel
90.0
11-13-2002 09:38:03 AM
81.0
11-13-2002 09:38:03 AM
The alert for BP Systolic was triggered on 11-13-2002
vince
wheatcher
tester2
120.0
78.0
01-01-2003 08:53:02 PM
88.0
01-01-2003 08:53:02 PM
94.6
01-01-2003 08:38:16 PM
The alert for Heart Rate was triggered on 12-28-2002
default
0.0
0.0
01-01-1970 12:00:00 AM
01-01-1970 12:00:00 AM
The alert for Heart Rate was triggered on 12-22-2002
testers
tester1
tester10
vince
4

Fig. 23

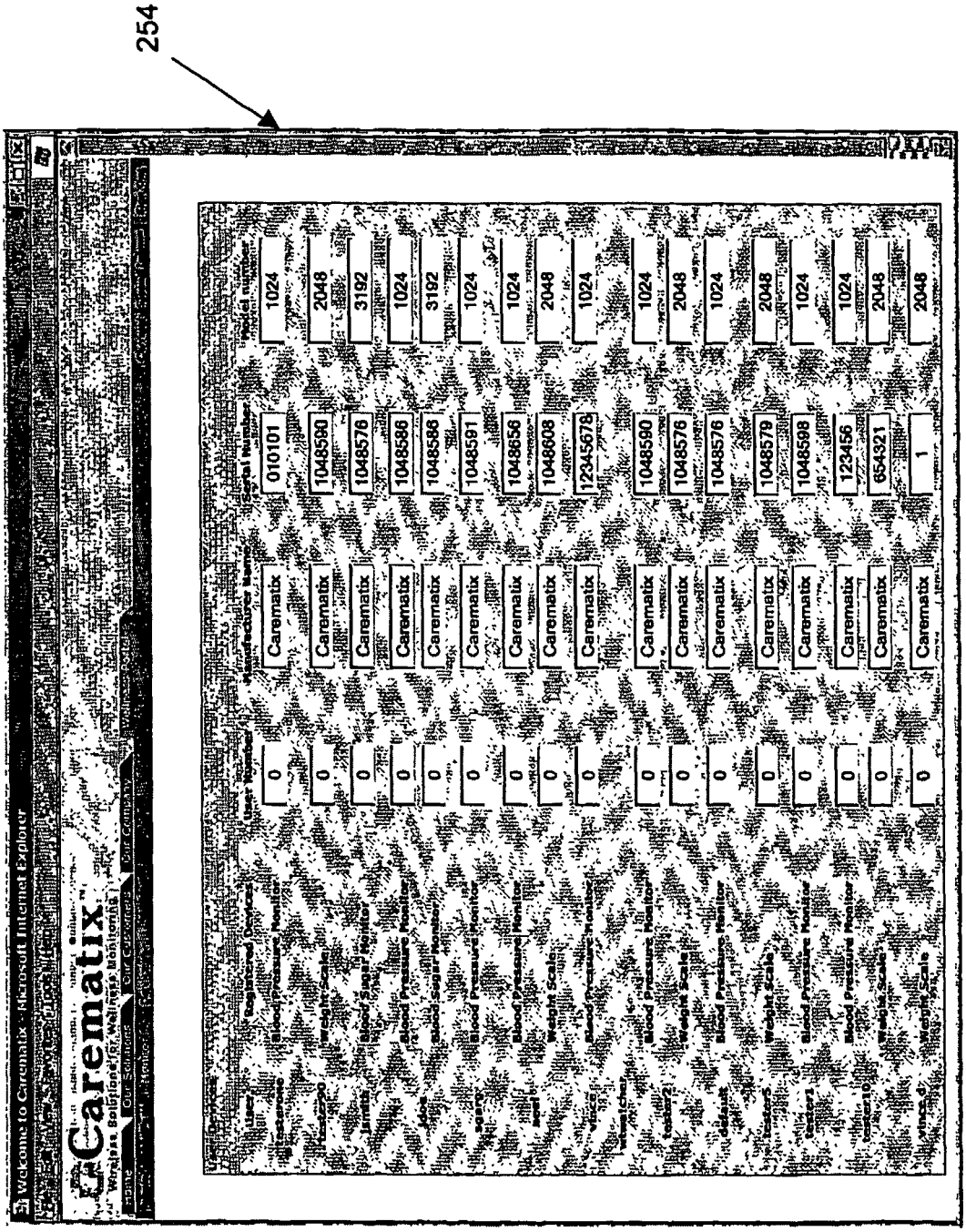
254
Caremätix
Welcome to Caremätix - Microsoft Internet Explorer
Caremätix
Wireless Solutions
Care Coordinator
Wireless Solutions
Blood Pressure Monitor
Weight Scale
Blood Sugar Monitor
Caremätix
1048590
1048576
1048586
1048588
1048591
1048656
1048608
12345678
1048590
1048576
1048576
1048579
1048598
123456
654321
1
010101
1024
2048
3192
1024
3192
1024
1024
2048
1024
1024
2048
1024
1024
2048
1024
1024
2048
1024
2048

Fig. 24

```
 Volume in drive F is CAREMATIX SRC
 Volume Serial Number is EB59-B6BE

 Directory of F:\

04/14/2003  06:08a      <DIR>          Device
04/14/2003  06:08a      <DIR>          Server
               0 File(s)              0 bytes

 Directory of F:\Device

04/14/2003  06:08a      <DIR>          .
04/14/2003  06:08a      <DIR>          ..
04/13/2003  05:02a              239,652 HUBCC.LST
04/13/2003  05:02a              354,662 LOPWRBP.LST
04/13/2003  05:02a              404,552 MODEMHUB.LST
               3 File(s)        998,866 bytes

 Directory of F:\Server

04/14/2003  06:08a      <DIR>          .
04/14/2003  06:08a      <DIR>          ..
04/14/2003  06:08a      <DIR>          iModem
04/14/2003  06:08a      <DIR>          UI
04/14/2003  06:08a      <DIR>          Webapp
               0 File(s)              0 bytes

 Directory of F:\Server\iModem

04/14/2003  06:08a      <DIR>          .
04/14/2003  06:08a      <DIR>          ..
04/14/2003  06:03a                7,178 v.java
04/14/2003  06:03a                1,334 vw.java
04/14/2003  06:03a                  745 vx.java
04/14/2003  06:03a                  436 vxw.java
04/14/2003  06:03a                  433 vy.java
04/14/2003  06:03a                4,151 wv.java
04/14/2003  06:03a                2,017 www.java
04/14/2003  06:03a                  715 wwy.java
04/14/2003  06:03a                  427 wx.java
04/14/2003  06:03a                1,449 wxw.java
04/14/2003  06:03a                1,258 wzw.java
04/14/2003  06:03a                1,339 xvw.java
04/14/2003  06:03a                1,469 xww.java
04/14/2003  06:03a                1,879 xx.java
04/14/2003  06:03a                  953 yyw.java
04/14/2003  06:03a                  431 zv.java
04/14/2003  06:03a                  367 zw.java
04/14/2003  06:03a                1,958 zyw.java
04/14/2003  06:03a                  298 zzw.java
04/14/2003  06:03a               17,751 zzy.java
              20 File(s)         46,588 bytes

 Directory of F:\Server\UI

04/14/2003  06:08a      <DIR>          .
04/14/2003  06:08a      <DIR>          ..
```

```
11/13/2002  06:39p              16,248 About_us.htm
11/20/2002  04:30p              12,440 about_us.html
01/18/2003  01:11p                 709 accountcreationsuccess.jsp
03/12/2003  05:04p               4,856 admin_list.html
01/18/2003  12:42p               9,697 admin_monitor.jsp
03/12/2003  05:10p               5,292 admin_user_assign_unassign.htm
01/15/2003  10:17a               4,186 admin_navigation.jsp
01/22/2003  02:01p              10,219 admin_user_devices.jsp
01/16/2003  11:32a              10,775 admin_user_devices_alt.jsp
02/10/2003  05:01p              13,740 alert.jsp
12/04/2002  12:52p                 740 alerts.html
02/10/2003  04:28p               4,851 alreadylogin.jsp
12/04/2002  12:43p                 714 arm.html
11/13/2002  06:39p              22,835 Asthama.htm
11/13/2002  06:39p               5,154 banner.jsp
01/20/2003  01:15p               2,198 bpfilter.jsp
03/15/2003  04:58p               3,315 bptable.jsp
11/13/2002  06:39p               2,429 carematix.css
11/13/2002  06:39p               1,979 Carematix.html
11/15/2002  04:40p               1,134 carematix.js
01/15/2003  02:27p               6,921 cart.jsp
01/14/2003  02:35p               1,795 catalogue.jsp
12/04/2002  12:52p                 747 central.html
11/15/2002  04:40p                 694 changetononsecure.jsp
11/15/2002  04:40p                 697 changetosecure.jsp
01/22/2003  02:57p              14,491 chart.jsp
12/04/2002  12:52p                 753 charts.html
01/14/2003  02:38p               7,938 checkout.jsp
04/14/2003  06:08a       <DIR>         cm
03/12/2003  09:17a               5,913 cm.css
11/13/2002  06:39p              16,729 CompanyOverview.htm
11/13/2002  06:39p              16,275 Company_Overview.htm
11/19/2002  01:29p              13,509 conditions.html
11/13/2002  06:39p              34,636 Conditions_of_use.htm
01/20/2003  01:20p               4,989 confirmations.jsp
11/19/2002  01:27p               1,590 contact.html
11/13/2002  06:39p              11,509 contactus.htm
11/13/2002  06:39p              14,015 contact_us.htm
11/13/2002  06:39p              26,098 COPD.htm
01/20/2003  01:44p              15,622 createnewaccount.jsp
12/04/2002  01:26p              20,693 customer.html
11/13/2002  06:39p              21,497 Customer_support.htm
12/04/2002  12:51p                 749 dashboard.html
11/19/2002  01:04p               2,865 dataupload.jsp
11/13/2002  06:39p              19,428 Development_team.htm
01/20/2003  01:45p               3,947 deviceconfirmations.jsp
11/15/2002  04:40p                 653 devicecontrol.jsp
11/13/2002  06:39p              21,765 Diabetes.htm
12/04/2002  12:48p                 715 diagram.html
11/19/2002  01:28p               1,123 employment.html
01/21/2003  11:18a               2,079 endDateCalendar.jsp
02/10/2003  04:11p                 737 errorpage.html
02/10/2003  04:03p                 661 errorpage.jsp
11/13/2002  06:39p               5,900 error_msg.htm
01/20/2003  01:52p               3,083 filterreadings.jsp
12/30/2002  03:14p                 353 footer.jsp
11/15/2002  04:40p                 177 frame.jsp
```

```
11/13/2002  06:39p                1,983 GE.html
12/04/2002  12:48p                  726 glucometer.html
11/13/2002  06:39p                1,985 Healthcare.html
12/04/2002  10:46a                5,323 home.html
11/13/2002  06:39p               17,741 Hypertension.htm
04/14/2003  06:08a       <DIR>          images
01/31/2003  12:38p                  378 index.jsp
12/27/2002  11:56a                  551 index_comp.html
12/27/2002  11:55a                  550 index_cust.html
12/27/2002  11:53a                  552 index_solu.html
11/15/2002  05:03p                  547 index.html
11/13/2002  06:39p               11,656 Investors.htm
11/15/2002  04:40p                2,028 isdataupload.jsp
11/13/2002  06:39p                1,488 leftregistration.jsp
02/10/2003  04:28p                5,722 leftalert.jsp
01/14/2003  03:35p                4,065 leftcheckout.jsp
01/14/2003  03:36p                4,061 leftconfirmations.jsp
01/14/2003  03:36p                4,061 leftcreatenewaccount.jsp
02/10/2003  04:15p                6,938 leftindex.jsp
11/15/2002  04:40p                2,524 leftindexredirect.jsp
01/14/2003  03:37p                4,066 leftorderconfirmations.jsp
01/14/2003  03:38p                4,066 leftorderpayments.jsp
01/14/2003  03:39p                4,078 leftordersummary.jsp
01/14/2003  03:39p                4,060 leftpayments.jsp
01/14/2003  03:40p                4,072 leftpickservice.jsp
01/15/2003  02:25p                1,590 leftproducts.jsp
01/14/2003  03:42p                5,126 leftregisterdevice.jsp
01/14/2003  03:43p                4,065 leftregisteredconfirmations.jsp
01/14/2003  03:44p                4,066 leftregisteredpayments.jsp
01/14/2003  03:45p                4,065 leftregisteredpickservice.jsp
01/15/2003  11:34a                4,062 leftsecurelogin.jsp
02/10/2003  04:29p                6,593 leftwelcome.jsp
03/13/2003  12:01p                1,223 left_admin_users_navigation.jsp
02/10/2003  04:15p                5,689 login.jsp
11/13/2002  06:39p               21,604 Management_Team.htm
12/04/2002  11:23a                8,839 markets.html
01/09/2003  12:24p                  500 navigation.jsp
11/13/2002  06:39p               16,017 news.htm
11/19/2002  01:23p                1,906 news.html
01/22/2003  03:39p                  314 newwindow.js
11/13/2002  06:39p               14,844 Obesity.htm
11/15/2002  04:40p                1,823 openecho.jsp
01/20/2003  01:58p                6,152 orderconfirmations.jsp
01/20/2003  02:05p               35,654 orderpayments.jsp
01/20/2003  02:05p                1,585 ordersummary.jsp
12/04/2002  12:17p                4,111 overview.html
01/20/2003  02:09p               33,212 payments.jsp
01/20/2003  02:17p               10,448 pickservice.jsp
11/19/2002  01:29p               19,401 potential.html
11/13/2002  06:39p               52,582 Potential_Users.htm
11/13/2002  06:39p               18,462 Preeclampsia.htm
11/15/2002  04:46p               24,965 privacy.html
11/13/2002  06:39p               51,197 privacy_policy.htm
11/13/2002  06:39p               14,656 products.htm
01/16/2003  01:43p                5,949 products.jsp
12/04/2002  11:05a               20,235 products.html
01/15/2003  02:13p                3,663 productdetails.jsp
```

```
01/20/2003  02:23p               8,194 registeredpickservice.jsp
01/18/2003  01:11p              16,246 registerdevice.jsp
01/20/2003  02:20p               5,478 registeredconfirmations.jsp
01/16/2003  01:55p               4,980 registeredDeviceDetails.jsp
01/15/2003  02:15p              32,405 registeredpayments.jsp
01/21/2003  02:01p              20,779 reminders.jsp
11/13/2002  06:39p              16,597 Secure_login.htm
02/10/2003  04:15p               6,025 securelogin.jsp
12/04/2002  05:53p               8,686 services.html
11/13/2002  06:39p              14,591 service_plans.htm
01/18/2003  01:11p               1,302 showAlert.jsp
11/15/2002  04:40p               1,545 signonredirector.jsp
01/18/2003  01:11p                 605 signonsucessfull.jsp
12/04/2002  10:51a               4,268 solutions.html
02/10/2003  06:18p               2,080 startDateCalendar.jsp
11/08/2002  11:08a                 559 sub_frame_potential.html
11/08/2002  10:11a                 558 sub_frame_overview.html
11/08/2002  11:08a                 556 sub_frame_privacy.html
12/09/2002  01:23p               3,655 subnav_home.html
12/09/2002  01:23p               3,966 subnav_overview.html
12/09/2002  01:22p               3,881 subnav_services.html
12/09/2002  01:23p               3,856 subnav_solutions.html
11/08/2002  11:07a                 559 sub_frame_conditions.html
11/08/2002  11:07a                 557 sub_frame_contact.html
11/08/2002  10:09a                 550 sub_frame_home.html
11/08/2002  11:02a                 554 sub_frame_news.html
11/08/2002  10:11a                 558 sub_frame_services.html
11/14/2002  02:53p                 560 sub_frame_solutions.html
12/09/2002  01:23p               3,587 subnav_support.html
11/15/2002  08:26a                 557 sub_frame_support.html
11/13/2002  06:39p              26,233 summary.htm
12/04/2002  11:12a               8,568 support.html
01/22/2003  03:05p              14,265 table.jsp
02/10/2003  04:52p               4,892 template.jsp
11/15/2002  04:40p                 442 templatexml.jsp
01/20/2003  01:14p               1,906 tempraturefilter.jsp
03/15/2003  04:59p               2,723 tempraturetable.jsp
12/30/2002  12:09p                  67 topindex.jsp
01/31/2003  12:28p               1,126 top.html
01/22/2003  02:23p              44,577 trends.jsp
03/12/2003  05:06p               3,896 unassigned_user_list.htm
11/13/2002  06:39p              11,648 Untitled-1.html
01/18/2003  01:11p               3,916 usernotification.jsp
03/12/2003  05:06p               4,715 user_list.htm
11/13/2002  06:39p              15,501 web_services.htm
12/04/2002  12:43p                 717 weight.html
01/20/2003  02:26p               1,957 weightfilter.jsp
03/15/2003  04:58p               2,705 weighttable.jsp
03/14/2003  04:52p              23,336 welcome.jsp
11/13/2002  06:39p              21,571 Welcome to Carematix.htm
11/13/2002  06:39p               1,986 Wipro.html
12/04/2002  12:48p                 730 wrist.html
             164 File(s)      1,298,447 bytes

 Directory of F:\Server\UI\cm

04/14/2003  06:08a      <DIR>          .
```

```
04/14/2003  06:08a      <DIR>          ..
01/16/2003  05:38p              10,813 cm.css
11/27/2002  10:36a               3,043 floater.js
               2 File(s)         13,856 bytes

 Directory of F:\Server\UI\images

04/14/2003  06:08a      <DIR>          .
04/14/2003  06:08a      <DIR>          ..
03/12/2003  08:22a                 564 admin_list.gif
03/12/2003  08:23a                 565 admin_list_over.gif
12/04/2002  12:33p              15,474 admin_preview.gif
11/15/2002  04:39p               3,053 alert.gif
11/11/2002  01:57p              13,048 alerts.gif
12/04/2002  12:35p              17,669 alerts_preview.gif
03/12/2003  08:23a                 546 all_users.gif
03/12/2003  08:23a                 549 all_users_over.gif
12/04/2002  01:00p               5,605 arm.gif
12/04/2002  12:37p              16,653 arm_preview.gif
01/21/2003  10:17a                 104 arrow_up.gif
01/21/2003  10:19a                 106 arrow_down.gif
03/12/2003  08:25a                 524 assign.gif
03/12/2003  08:26a                 524 assign_over.gif
11/11/2002  01:56p                 637 back.gif
11/15/2002  04:39p               4,048 Banner.GIF
11/15/2002  04:39p                 907 bm.gif
11/15/2002  04:39p              14,744 bp_big1.gif
11/15/2002  04:39p              13,310 bp_big2.gif
11/15/2002  04:39p              17,724 bp_big3.gif
11/15/2002  04:39p               5,550 bp_small1.gif
11/15/2002  04:39p               5,228 bp_small2.gif
11/15/2002  04:39p               5,902 bp_small3.gif
11/15/2002  04:39p               3,543 Buddy.gif
11/15/2002  04:39p                 571 buddy_blue.gif
11/15/2002  04:39p                 572 buddy_green.gif
11/15/2002  04:39p               2,579 Buddy_list.gif
04/14/2003  06:08a      <DIR>          Button
11/15/2002  04:40p                 923 by.gif
01/21/2003  11:13a                 440 cal.gif
11/15/2002  04:40p                  90 cart_deactivate.gif
11/15/2002  04:40p                  90 cart_trial.gif
11/15/2002  04:40p                  90 cart_trial_over.gif
12/04/2002  01:03p               7,511 central.gif
12/04/2002  01:05p               8,639 charts.gif
12/04/2002  12:39p              18,540 charts_preview.gif
11/15/2002  04:40p               1,751 Checkout.gif
12/26/2002  11:40a               2,720 checkout_step1.gif
12/26/2002  11:40a               2,697 checkout_step2.gif
12/26/2002  11:41a               2,680 checkout_step3.gif
12/26/2002  11:41a               2,669 checkout_step4.gif
11/15/2002  04:40p                 292 code.gif
11/15/2002  04:40p              40,216 collage.gif
12/26/2002  11:37a               4,031 combo_timeline.gif
11/15/2002  04:40p               2,015 confirmation.gif
12/04/2002  12:57p               6,717 dashboard.gif
12/04/2002  12:40p              14,152 dashboard_preview.gif
03/12/2003  08:25a                 709 demote.gif
```

```
03/12/2003  08:25a                712 demote_over.gif
11/15/2002  04:40p              2,878 devices.gif
12/04/2002  12:58p              7,730 diagram.gif
12/04/2002  12:30p              7,228 diagram_home.gif
12/04/2002  12:32p             15,646 diagram_preview.gif
11/11/2002  01:53p             10,276 doctor.gif
11/12/2002  03:10p              6,787 doctor.jpg
01/21/2003  10:17a                108 dot.gif
11/11/2002  01:47p                 62 end_cap.gif
11/11/2002  01:06p                131 end_slant.gif
11/11/2002  01:03p                 82 end_slant_2.gif
01/21/2003  10:16a                 99 equal.gif
01/21/2003  10:16a                331 ERROR.GIF
11/15/2002  04:40p              6,343 EX11.JPG
01/21/2003  10:14a                146 exclaim.gif
01/21/2003  10:13a                124 exclamation.gif
11/15/2002  04:40p              1,242 execute.gif
12/04/2002  12:35p             17,783 glucometer_preview.gif
11/11/2002  02:01p              6,793 glucose.gif
12/04/2002  12:58p             16,607 irwin.gif
01/15/2003  10:04a                148 logged_in.gif
01/15/2003  10:05a                149 logged_out.gif
10/11/2002  10:38a              3,255 logo_top.gif
03/12/2003  08:26a                619 make_admin.gif
03/12/2003  08:26a                622 make_admin_over.gif
11/15/2002  04:40p              2,356 myhealth.gif
12/04/2002  01:01p             14,671 navneet.gif
11/15/2002  04:40p                908 nm.gif
11/15/2002  04:40p                925 ny.gif
11/15/2002  04:40p              1,948 order_summary.gif
11/15/2002  04:40p              2,018 payments.gif
12/30/2002  02:29p              3,418 per_step1.gif
12/26/2002  11:38a              3,350 per_step3.gif
12/26/2002  11:39a              3,319 per_step4.gif
12/26/2002  11:39a              3,311 per_step5.gif
01/02/2003  02:39p                 43 pixel.gif
12/04/2002  12:57p              6,576 praveen.gif
01/21/2003  10:13a                227 print.gif
04/14/2003  06:08a       <DIR>        Products
11/15/2002  04:40p              2,075 registeredstep1.gif
11/15/2002  04:40p              2,124 registeredstep2.gif
11/15/2002  04:40p              2,092 registeredstep3.gif
11/15/2002  04:40p              2,010 registeredstep4.gif
12/26/2002  11:42a              2,922 reg_add_step1.gif
12/26/2002  11:42a              2,912 reg_add_step2.gif
12/26/2002  11:43a              2,900 reg_add_step3.gif
12/26/2002  11:43a              2,873 reg_add_step4.gif
01/21/2003  10:28a                532 reminders.gif
01/21/2003  10:29a                526 reminders_over.gif
11/15/2002  04:40p              1,231 return.gif
12/04/2002  01:01p             14,012 sandeep.gif
11/15/2002  04:40p                124 secure_lock.gif
11/15/2002  04:40p                908 select.gif
01/13/2003  03:55p                 85 separator.gif
11/11/2002  01:00p                101 slant_1.gif
11/11/2002  12:59p                137 slant_1a.gif
11/11/2002  01:05p                110 slant_2.gif
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11/11/2002  01:01p                131 slant_3.gif
04/19/2002  10:32a                 79 spacer.GIF
11/11/2002  01:46p                 76 start_cap.gif
11/15/2002  04:40p              2,184 Step1.gif
11/15/2002  04:40p              2,444 Step2.gif
11/15/2002  04:40p              2,466 Step3.gif
11/15/2002  04:40p              2,456 Step4.gif
11/15/2002  04:40p              2,373 Step5.gif
12/04/2002  01:00p             15,619 stu.gif
12/04/2002  12:59p             12,543 sukwant.gif
01/13/2003  01:35p                437 swoosh.gif
11/11/2002  01:03p                 51 tab_1.gif
11/11/2002  01:04p                 50 tab_2.gif
11/15/2002  04:40p              4,291 thermo_small2.gif
11/15/2002  04:40p              2,359 thermo_small3.gif
11/15/2002  04:40p             14,154 thermo_big1.gif
11/15/2002  04:40p             12,308 thermo_big2.gif
11/15/2002  04:40p              5,640 thermo_big3.gif
11/15/2002  04:40p              4,318 thermo_small1.gif
12/04/2002  01:03p              4,988 top_header.gif
10/11/2002  10:40a                 49 top_tile.gif
11/15/2002  04:40p              3,250 trends.gif
03/12/2003  09:15a                568 unassign.gif
03/12/2003  08:24a                751 unassigned_users.gif
03/12/2003  08:24a                754 unassigned_users_over.gif
03/12/2003  09:16a                568 unassign_over.gif
01/17/2003  02:26p                560 update_baseline.gif
01/17/2003  02:26p                552 update_baseline_over.gif
01/17/2003  02:25p                608 Update_my_account.gif
01/17/2003  02:25p                604 Update_my_account_over.gif
03/15/2003  04:36p              1,152 vssver.scc
11/11/2002  02:01p              8,273 weight.gif
12/04/2002  12:36p             17,879 weight_preview.gif
11/11/2002  02:03p              9,514 wrist.gif
12/04/2002  12:34p             18,599 wrist_preview.gif
11/15/2002  04:40p              5,396 wt_scale_small2.gif
11/15/2002  04:40p              5,681 wt_scale_small3.gif
11/15/2002  04:40p             18,491 wt_scale_big1.gif
11/15/2002  04:40p             13,630 wt_scale_big2.gif
11/15/2002  04:40p             15,480 wt_scale_big3.gif
11/15/2002  04:40p              6,737 wt_scale_small1.gif
             144 File(s)        671,979 bytes

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04/14/2003  06:08a      <DIR>          .
04/14/2003  06:08a      <DIR>          ..
11/15/2002  04:39p              1,409 About_Us.gif
11/15/2002  04:39p              1,409 About_Us_over.gif
01/17/2003  01:46p                744 accept_displayed_readings.gif
01/17/2003  01:40p                910 accept_displayed_readings_o.gif
01/17/2003  01:40p                910 accept_displayed_readings_over.gif
01/17/2003  01:45p                568 add_to_cart.gif
01/17/2003  01:46p                550 add_to_cart_over.gif
01/17/2003  01:44p                625 admin_monitor.gif
01/17/2003  01:44p                595 admin_monitor_over.gif
01/17/2003  01:43p                513 calendar.gif
```

```
01/17/2003  01:43p               505 calendar_over.gif
01/17/2003  01:42p               459 cancel.gif
01/17/2003  01:42p               455 cancel_over.gif
11/15/2002  04:39p               761 cart.gif
11/15/2002  04:39p               761 cart_over.gif
11/15/2002  04:39p             2,318 change_per_alerts.gif
11/15/2002  04:39p             2,320 change_per_alerts_over.gif
01/17/2003  01:41p               430 chart.gif
01/17/2003  01:41p               422 chart_over.gif
01/17/2003  01:54p               536 checkout.gif
01/17/2003  01:55p               526 checkout_over.gif
01/17/2003  01:54p               589 continue_shopping_over.gif
01/17/2003  01:53p               517 continue.gif
11/15/2002  04:39p             1,513 continue-shopping.gif
11/15/2002  04:39p             1,513 continue-shopping_over.gif
01/17/2003  01:54p               507 continue_over.gif
01/17/2003  01:53p               609 continue_shopping.gif
01/17/2003  01:52p               592 create_my_acct.gif
01/17/2003  01:52p               581 create_my_acct_over.gif
11/15/2002  04:39p             1,728 Customer_support.gif
11/15/2002  04:39p             1,728 Customer_support_over.gif
01/17/2003  01:50p               467 Delete.gif
01/17/2003  01:51p               454 Delete_over.gif
01/17/2003  01:50p               735 delete_selected_readings.gif
01/17/2003  01:51p               708 delete_selected_readings_ov.gif
01/17/2003  01:51p               708 delete_selected_readings_over.gif
01/22/2003  03:37p            15,364 .DS_Store
01/20/2003  03:07p               356 Enter.gif
01/20/2003  03:10p               359 Enter_over.gif
11/15/2002  04:39p               946 Enter_small.gif
11/15/2002  04:39p               946 Enter_small_over.gif
11/15/2002  04:39p             1,377 FAQs.gif
11/15/2002  04:39p             1,377 FAQs_over.gif
01/17/2003  01:48p               424 finish.gif
01/17/2003  01:48p               428 finish_over.gif
11/15/2002  04:39p               999 Go_For_Demo.gif
11/15/2002  04:39p               999 Go_For_Demo_over.gif
11/15/2002  04:39p             1,375 Home.gif
11/15/2002  04:39p             1,375 Home_over.gif
11/15/2002  04:39p             2,284 Invite_buddy.gif
11/15/2002  04:39p             2,285 Invite_buddy_over.gif
01/22/2003  02:48p               628 last_months.gif
01/22/2003  02:49p               610 last_months_charts.gif
01/22/2003  02:49p               589 last_months_charts_over.gif
01/22/2003  02:49p               624 last_months_over.gif
01/22/2003  02:48p               648 last_weeks.gif
01/22/2003  02:47p               613 last_weeks_charts.gif
01/22/2003  02:47p               605 last_weeks_charts_over.gif
01/22/2003  02:46p               636 last_weeks_over.gif
11/15/2002  04:39p             1,425 Learn_more.gif
11/15/2002  04:39p             1,425 Learn_more_over.gif
11/15/2002  04:39p               953 my_acct.gif
11/15/2002  04:39p               953 my_acct_over.gif
11/15/2002  04:39p             1,345 News.gif
11/15/2002  04:39p               949 news_disable.gif
11/15/2002  04:39p             1,345 News_over.gif
01/17/2003  02:09p               518 payments.gif
```

```
01/17/2003  01:47p               531 payments_over.gif
01/17/2003  02:08p               577 Pick_service.gif
01/17/2003  02:08p               570 Pick_service_over.gif
11/15/2002  04:39p             1,408 Products.gif
11/15/2002  04:39p             1,408 Products_over.gif
11/15/2002  04:39p               917 profile.gif
11/15/2002  04:39p               987 profile_disable.gif
11/15/2002  04:39p               917 profile_over.gif
01/17/2003  02:07p               590 recalculate.gif
01/17/2003  02:08p               578 recalculate_over.gif
01/20/2003  03:08p               497 register_over.gif
01/20/2003  03:07p               507 register.gif
01/17/2003  02:06p               585 register_a_device.gif
01/17/2003  02:06p               570 register_a_device_over.gif
01/17/2003  02:05p               645 register_more_devices.gif
01/17/2003  02:05p               638 register_more_devices_over.gif
11/15/2002  04:39p               997 reminders.gif
11/15/2002  04:39p               997 reminders_over.gif
01/17/2003  02:04p               439 Reset.gif
01/17/2003  02:03p               439 Reset1.gif
01/17/2003  02:03p               437 Reset1_over.gif
01/17/2003  02:04p               437 Reset_over.gif
11/15/2002  04:40p             1,400 Services.gif
11/15/2002  04:40p             1,400 Services_over.gif
01/17/2003  03:54p               550 set_alerts.gif
01/17/2003  03:52p               527 set_alerts_over.gif
01/17/2003  03:53p               560 set_trends.gif
01/17/2003  03:53p               550 set_trends_over.gif
01/17/2003  02:02p               479 submit.gif
01/17/2003  02:03p               476 submit_over.gif
11/15/2002  04:40p               916 tables.gif
11/15/2002  04:40p               983 tables_disable.gif
11/15/2002  04:40p               916 tables_over.gif
11/15/2002  04:40p             1,423 Take_a_Tour.gif
11/15/2002  04:40p             1,016 Take_a_Tour_disable.gif
11/15/2002  04:40p             1,423 Take_a_Tour_over.gif
01/17/2003  02:01p               599 Track_orders.gif
01/17/2003  02:02p               584 Track_orders_over.gif
01/20/2003  03:08p               559 unregister.gif
01/20/2003  03:09p               551 unregister_over.gif
11/15/2002  04:40p             1,533 Update_my_account.gif
01/17/2003  02:25p               476 update_over.gif
01/17/2003  02:25p               608 Update_my_acct.gif
01/17/2003  02:25p               604 Update_my_acct_over.gif
01/17/2003  02:24p               492 update_small.gif
01/17/2003  02:23p               490 update.gif
01/17/2003  02:26p               560 update_baseline.gif
01/17/2003  02:26p               552 update_baseline_over.gif
11/15/2002  04:40p             1,410 update_cart.gif
11/15/2002  04:40p             1,410 update_cart_over.gif
11/15/2002  04:40p             1,538 Update_my_account_over.gif
01/17/2003  02:24p               425 update_small_over.gif
01/17/2003  02:23p               590 user_devices.gif
01/17/2003  02:23p               598 user_devices_over.gif
01/17/2003  02:22p               413 view.gif
01/17/2003  02:22p               410 view_over.gif
03/15/2003  04:36p             1,696 vssver.scc
```

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               124 File(s)        119,823 bytes

 Directory of F:\Server\UI\images\Products

04/14/2003  06:08a       <DIR>          .
04/14/2003  06:08a       <DIR>          ..
11/15/2002  04:40p                   898 bp01.jpg
11/15/2002  04:40p                13,310 bp02.gif
11/15/2002  04:40p                13,310 bpmeter.gif
11/15/2002  04:40p                   898 bpmeter.jpg
11/15/2002  04:40p                14,744 bp_big1.gif
11/15/2002  04:40p                 5,228 bp_small2.gif
11/15/2002  04:40p                 1,170 glucomter.jpg
11/15/2002  04:40p                   824 HeartRate monitor.jpg
11/15/2002  04:40p                12,653 thermo02.jpg
11/15/2002  04:40p                 5,640 thermo1.gif
11/15/2002  04:40p                 7,443 thermo1.jpg
11/15/2002  04:40p                 5,640 thermometer.gif
11/15/2002  04:40p                   536 thermometer.jpg
03/15/2003  04:36p                   304 vssver.scc
11/15/2002  04:40p                15,480 weigh01.gif
11/15/2002  04:40p                 1,101 weigh02.jpg
11/15/2002  04:40p                15,480 weightscale.gif
11/15/2002  04:40p                 1,101 weightscale.jpg
              18 File(s)        115,760 bytes

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04/14/2003  06:08a       <DIR>          .
04/14/2003  06:08a       <DIR>          ..
04/14/2003  05:58a                   836 v.java
04/14/2003  05:58a                   406 vv.java
04/14/2003  05:58a                   539 vvvv.java
04/14/2003  05:58a                23,271 vvvw.java
04/14/2003  05:58a                   407 vvvx.java
04/14/2003  05:58a                 3,533 vvvy.java
04/14/2003  05:58a                 1,431 vvv.java
04/14/2003  05:58a                 1,287 vvwv.java
04/14/2003  05:58a                 2,833 vvww.java
04/14/2003  05:58a                 1,618 vvwx.java
04/14/2003  05:58a                   824 vvwy.java
04/14/2003  05:58a                 1,399 vvw.java
04/14/2003  05:58a                 1,382 vvxv.java
04/14/2003  05:58a                   325 vvxw.java
04/14/2003  05:58a                 9,959 vvxy.java
04/14/2003  05:58a                   589 vvx.java
04/14/2003  05:58a                 1,706 vvyv.java
04/14/2003  05:58a                   273 vvyw.java
04/14/2003  05:58a                   457 vvyx.java
04/14/2003  05:58a                 4,389 vvyy.java
04/14/2003  05:58a                 1,237 vvy.java
04/14/2003  05:58a                   582 vvzv.java
04/14/2003  05:58a                 3,053 vvzw.java
04/14/2003  05:58a                 2,339 vvzx.java
04/14/2003  05:58a                   918 vvzy.java
04/14/2003  05:58a                   265 vw.java
04/14/2003  05:58a                 3,600 vwvv.java
```

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04/14/2003  05:58a             1,013 vwvw.java
04/14/2003  05:58a               907 vwvx.java
04/14/2003  05:58a             3,728 vwvy.java
04/14/2003  05:58a               298 vwv.java
04/14/2003  05:58a               440 vwwv.java
04/14/2003  05:58a             3,434 vwww.java
04/14/2003  05:58a               629 vwwx.java
04/14/2003  05:58a             1,587 vwwy.java
04/14/2003  05:58a               362 vww.java
04/14/2003  05:58a               951 vwxv.java
04/14/2003  05:58a               498 vwxw.java
04/14/2003  05:58a             1,403 vwxx.java
04/14/2003  05:58a               454 vwxy.java
04/14/2003  05:58a             1,836 vwx.java
04/14/2003  05:58a             1,172 vwyv.java
04/14/2003  05:58a             1,188 vwyw.java
04/14/2003  05:58a               431 vwyx.java
04/14/2003  05:58a               422 vwyy.java
04/14/2003  05:58a               237 vwy.java
04/14/2003  05:58a               457 vwzv.java
04/14/2003  05:58a               873 vwzw.java
04/14/2003  05:58a               857 vwzx.java
04/14/2003  05:58a               359 vwzy.java
04/14/2003  05:58a               745 vx.java
04/14/2003  05:58a             1,031 vxvv.java
04/14/2003  05:58a               708 vxvw.java
04/14/2003  05:58a               392 vxvx.java
04/14/2003  05:58a               543 vxvy.java
04/14/2003  05:58a             7,436 vxv.java
04/14/2003  05:58a             8,275 vxwv.java
04/14/2003  05:58a             1,268 vxww.java
04/14/2003  05:58a               190 vxwx.java
04/14/2003  05:58a             1,993 vxwy.java
04/14/2003  05:58a             5,845 vxw.java
04/14/2003  05:58a             7,364 vxxv.java
04/14/2003  05:58a             6,707 vxxw.java
04/14/2003  05:58a             2,652 vxxy.java
04/14/2003  05:58a               276 vxx.java
04/14/2003  05:58a               834 vxyv.java
04/14/2003  05:58a             1,552 vxyw.java
04/14/2003  05:58a             8,525 vxyx.java
04/14/2003  05:58a               382 vxyy.java
04/14/2003  05:58a             8,544 vxy.java
04/14/2003  05:58a             2,196 vxzv.java
04/14/2003  05:58a               490 vxzw.java
04/14/2003  05:58a               924 vxzx.java
04/14/2003  05:58a             1,135 vxzy.java
04/14/2003  05:58a               455 vy.java
04/14/2003  05:58a             1,769 vyvv.java
04/14/2003  05:58a            10,043 vyvw.java
04/14/2003  05:58a               432 vyvx.java
04/14/2003  05:58a             1,075 vyvy.java
04/14/2003  05:58a               474 vyv.java
04/14/2003  05:58a             1,057 vywv.java
04/14/2003  05:58a               537 vyww.java
04/14/2003  05:58a               457 vywx.java
04/14/2003  05:58a               529 vywy.java
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04/14/2003  05:58a               944 vyw.java
04/14/2003  05:58a             5,718 vyxv.java
04/14/2003  05:58a               441 vyxw.java
04/14/2003  05:58a             3,226 vyxy.java
04/14/2003  05:58a               527 vyx.java
04/14/2003  05:58a               402 vyyv.java
04/14/2003  05:58a            17,503 vyyw.java
04/14/2003  05:58a               382 vyyx.java
04/14/2003  05:58a            15,837 vyyy.java
04/14/2003  05:58a             1,262 vyy.java
04/14/2003  05:58a               455 vyzv.java
04/14/2003  05:58a               433 vyzw.java
04/14/2003  05:58a               385 vyzx.java
04/14/2003  05:58a               301 vyzy.java
04/14/2003  05:58a             7,534 vzvv.java
04/14/2003  05:58a               389 vzvw.java
04/14/2003  05:58a             2,827 vzvx.java
04/14/2003  05:58a               454 vzvy.java
04/14/2003  05:58a               284 vzv.java
04/14/2003  05:59a             8,073 vzwv.java
04/14/2003  05:59a               296 vzww.java
04/14/2003  05:59a            12,249 vzwx.java
04/14/2003  05:59a             1,080 vzwy.java
04/14/2003  05:58a               502 vzw.java
04/14/2003  05:59a             1,062 vzxv.java
04/14/2003  05:59a             2,204 vzxw.java
04/14/2003  05:59a             1,125 vzxx.java
04/14/2003  05:59a             2,183 vzxy.java
04/14/2003  05:59a               914 vzx.java
04/14/2003  05:59a             1,643 vzyv.java
04/14/2003  05:59a               301 vzyw.java
04/14/2003  05:59a            23,947 vzyx.java
04/14/2003  05:59a               631 vzyy.java
04/14/2003  05:59a            32,802 vzy.java
04/14/2003  05:59a               257 vzzv.java
04/14/2003  05:59a             2,673 vzzw.java
04/14/2003  05:59a             3,322 vzzx.java
04/14/2003  05:59a               262 vzzy.java
04/14/2003  05:59a               530 w.java
04/14/2003  05:59a               966 wv.java
04/14/2003  05:59a             1,539 wvvv.java
04/14/2003  05:59a             2,998 wvvw.java
04/14/2003  05:59a               462 wvvx.java
04/14/2003  05:59a               384 wvvy.java
04/14/2003  05:59a             3,952 wvv.java
04/14/2003  05:59a               504 wvwv.java
04/14/2003  05:59a             6,145 wvww.java
04/14/2003  05:59a               393 wvwx.java
04/14/2003  05:59a               221 wvwy.java
04/14/2003  05:59a             1,042 wvw.java
04/14/2003  05:59a             2,308 wvxv.java
04/14/2003  05:59a             2,341 wvxw.java
04/14/2003  05:59a               945 wvxy.java
04/14/2003  05:59a               467 wvx.java
04/14/2003  05:59a             3,620 wvyv.java
04/14/2003  05:59a               438 wvyw.java
04/14/2003  05:59a               493 wvyx.java
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04/14/2003  05:59a               390 wvyy.java
04/14/2003  05:59a               713 wvy.java
04/14/2003  05:59a               405 wvzv.java
04/14/2003  05:59a             1,332 wvzw.java
04/14/2003  05:59a               394 wvzx.java
04/14/2003  05:59a               997 wvzy.java
04/14/2003  05:59a               271 ww.java
04/14/2003  05:59a             1,835 wwvv.java
04/14/2003  05:59a             1,423 wwvw.java
04/14/2003  05:59a             1,103 wwvx.java
04/14/2003  05:59a             9,640 wwvy.java
04/14/2003  05:59a             1,354 wwv.java
04/14/2003  05:59a               467 wwwv.java
04/14/2003  05:59a             1,152 wwww.java
04/14/2003  05:59a               511 wwwx.java
04/14/2003  05:59a            12,867 wwwy.java
04/14/2003  05:59a               293 www.java
04/14/2003  05:59a               618 wwxv.java
04/14/2003  05:59a             1,898 wwxw.java
04/14/2003  05:59a               308 wwxx.java
04/14/2003  05:59a             1,100 wwxy.java
04/14/2003  05:59a               386 wwx.java
04/14/2003  05:59a            11,514 wwyv.java
04/14/2003  05:59a             2,433 wwyw.java
04/14/2003  05:59a               687 wwyx.java
04/14/2003  05:59a               398 wwyy.java
04/14/2003  05:59a               602 wwy.java
04/14/2003  05:59a               801 wwzv.java
04/14/2003  05:59a               297 wwzw.java
04/14/2003  05:59a             4,454 wwzx.java
04/14/2003  05:59a             1,232 wwzy.java
04/14/2003  05:59a               243 wx.java
04/14/2003  05:59a               387 wxvv.java
04/14/2003  05:59a               374 wxvw.java
04/14/2003  05:59a               671 wxvx.java
04/14/2003  05:59a             5,515 wxvy.java
04/14/2003  05:59a               831 wxv.java
04/14/2003  05:59a               289 wxwv.java
04/14/2003  05:59a             1,088 wxww.java
04/14/2003  05:59a               430 wxwx.java
04/14/2003  05:59a             1,137 wxwy.java
04/14/2003  05:59a               382 wxw.java
04/14/2003  05:59a               614 wxxv.java
04/14/2003  05:59a             1,085 wxxw.java
04/14/2003  05:59a             1,074 wxxy.java
04/14/2003  05:59a             1,638 wxx.java
04/14/2003  05:59a               296 wxyv.java
04/14/2003  05:59a               314 wxyw.java
04/14/2003  05:59a             3,742 wxyx.java
04/14/2003  05:59a               612 wxyy.java
04/14/2003  05:59a            11,027 wxy.java
04/14/2003  05:59a            16,219 wxzv.java
04/14/2003  05:59a             8,761 wxzw.java
04/14/2003  05:59a             7,471 wxzx.java
04/14/2003  05:59a               727 wxzy.java
04/14/2003  05:59a             1,913 wy.java
04/14/2003  05:59a             3,024 wyvv.java
```

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04/14/2003  05:59a                301 wyvw.java
04/14/2003  05:59a              1,209 wyvx.java
04/14/2003  05:59a              7,854 wyvy.java
04/14/2003  05:59a              1,194 wyv.java
04/14/2003  05:59a              2,382 wywv.java
04/14/2003  05:59a              1,652 wyww.java
04/14/2003  05:59a                382 wywx.java
04/14/2003  05:59a                934 wywy.java
04/14/2003  05:59a              7,726 wyw.java
04/14/2003  05:59a              1,730 wyxv.java
04/14/2003  05:59a              2,149 wyxw.java
04/14/2003  05:59a                400 wyxx.java
04/14/2003  05:59a             30,517 wyxy.java
04/14/2003  05:59a                486 wyx.java
04/14/2003  05:59a                243 wyyv.java
04/14/2003  05:59a              3,113 wyyw.java
04/14/2003  05:59a              8,101 wyyx.java
04/14/2003  05:59a              5,041 wyyy.java
04/14/2003  05:59a                293 wyy.java
04/14/2003  05:59a                653 wyzv.java
04/14/2003  05:59a                832 wyzw.java
04/14/2003  05:59a              3,121 wyzx.java
04/14/2003  05:59a              4,159 wyzy.java
04/14/2003  05:59a                261 wzvv.java
04/14/2003  05:59a              1,867 wzvw.java
04/14/2003  05:59a                723 wzvx.java
04/14/2003  05:59a              1,969 wzvy.java
04/14/2003  05:59a                379 wzv.java
04/14/2003  05:59a                296 wzwv.java
04/14/2003  05:59a              1,066 wzww.java
04/14/2003  05:59a                806 wzwx.java
04/14/2003  05:59a                374 wzwy.java
04/14/2003  05:59a                464 wzw.java
04/14/2003  05:59a                469 wzxv.java
04/14/2003  05:59a                340 wzxw.java
04/14/2003  05:59a                901 wzxx.java
04/14/2003  05:59a                524 wzxy.java
04/14/2003  05:59a                219 wzx.java
04/14/2003  05:59a                996 wzyv.java
04/14/2003  05:59a                451 wzyw.java
04/14/2003  05:59a              1,136 wzyx.java
04/14/2003  05:59a                445 wzyy.java
04/14/2003  05:59a                688 wzy.java
04/14/2003  05:59a                797 wzzv.java
04/14/2003  05:59a                654 wzzw.java
04/14/2003  05:59a                296 wzzx.java
04/14/2003  05:59a              3,315 wzzy.java
04/14/2003  05:59a                262 x.java
04/14/2003  05:59a                380 xv.java
04/14/2003  05:59a              1,481 xvvv.java
04/14/2003  05:59a              1,568 xvvw.java
04/14/2003  05:59a              1,226 xvvx.java
04/14/2003  05:59a                436 xvvy.java
04/14/2003  05:59a              4,468 xvv.java
04/14/2003  05:59a                693 xvwv.java
04/14/2003  05:59a              9,394 xvww.java
04/14/2003  05:59a                409 xvwx.java
```

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04/14/2003  05:59a             1,489 xvwy.java
04/14/2003  05:59a               393 xvw.java
04/14/2003  05:59a             2,752 xvxv.java
04/14/2003  05:59a             1,406 xvxw.java
04/14/2003  05:59a             1,108 xvxy.java
04/14/2003  05:59a               293 xvx.java
04/14/2003  05:59a               190 xvyv.java
04/14/2003  05:59a               603 xvyw.java
04/14/2003  05:59a               459 xvyx.java
04/14/2003  05:59a               340 xvyy.java
04/14/2003  05:59a             1,166 xvy.java
04/14/2003  05:59a             1,287 xvzv.java
04/14/2003  05:59a               479 xvzw.java
04/14/2003  05:59a               450 xvzx.java
04/14/2003  05:59a               474 xvzy.java
04/14/2003  05:59a               576 xw.java
04/14/2003  05:59a             1,441 xwvv.java
04/14/2003  05:59a               591 xwvw.java
04/14/2003  05:59a             5,412 xwvx.java
04/14/2003  05:59a             3,844 xwvy.java
04/14/2003  05:59a               305 xwv.java
04/14/2003  05:59a            11,344 xwwv.java
04/14/2003  05:59a             4,363 xwww.java
04/14/2003  05:59a               429 xwwx.java
04/14/2003  05:59a             2,365 xwwy.java
04/14/2003  05:59a            12,440 xww.java
04/14/2003  05:59a               296 xwxv.java
04/14/2003  05:59a             1,440 xwxw.java
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04/14/2003  05:59a             1,074 xwxy.java
04/14/2003  05:59a               899 xwx.java
04/14/2003  05:59a             2,855 xwyv.java
04/14/2003  05:59a             4,471 xwyw.java
04/14/2003  05:59a            36,426 xwyx.java
04/14/2003  05:59a               327 xwyy.java
04/14/2003  05:59a               298 xwy.java
04/14/2003  05:59a               608 xwzv.java
04/14/2003  05:59a             1,719 xwzw.java
04/14/2003  05:59a               515 xwzx.java
04/14/2003  05:59a               377 xwzy.java
04/14/2003  05:59a               874 xx.java
04/14/2003  05:59a               451 xxvv.java
04/14/2003  05:59a               296 xxvw.java
04/14/2003  05:59a               221 xxvx.java
04/14/2003  05:59a            45,924 xxvy.java
04/14/2003  05:59a            10,925 xxv.java
04/14/2003  05:59a             9,190 xxwv.java
04/14/2003  05:59a            10,754 xxww.java
04/14/2003  05:59a            17,015 xxwx.java
04/14/2003  05:59a               392 xxwy.java
04/14/2003  05:59a               393 xxw.java
04/14/2003  05:59a               267 xxxv.java
04/14/2003  05:59a               277 xxxw.java
04/14/2003  05:59a               710 xxxy.java
04/14/2003  05:59a               448 xxx.java
04/14/2003  05:59a               411 xxyv.java
04/14/2003  05:59a             2,831 xxyw.java
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04/14/2003  05:59a                796 xxyy.java
04/14/2003  05:59a                474 xxy.java
04/14/2003  05:59a                239 xxzv.java
04/14/2003  05:59a                380 xxzw.java
04/14/2003  05:59a              1,650 xxzx.java
04/14/2003  05:59a              1,477 xxzy.java
04/14/2003  05:59a              1,655 xy.java
04/14/2003  05:59a              4,539 xyvv.java
04/14/2003  05:59a            108,998 xyvw.java
04/14/2003  05:59a                262 xyvx.java
04/14/2003  05:59a                308 xyvy.java
04/14/2003  05:59a             71,040 xyv.java
04/14/2003  05:59a                631 xywv.java
04/14/2003  05:59a              1,094 xyww.java
04/14/2003  05:59a             29,550 xywx.java
04/14/2003  05:59a                943 xywy.java
04/14/2003  05:59a                685 xyw.java
04/14/2003  05:59a                308 xyxv.java
04/14/2003  05:59a              1,205 xyxw.java
04/14/2003  05:59a                296 xyxy.java
04/14/2003  05:59a                527 xyx.java
04/14/2003  05:59a              5,527 xyyv.java
04/14/2003  05:59a                542 xyyw.java
04/14/2003  05:59a                838 xyyx.java
04/14/2003  05:59a                759 xyyy.java
04/14/2003  05:59a                267 xyy.java
04/14/2003  05:59a                991 xyzv.java
04/14/2003  05:59a                264 xyzw.java
04/14/2003  05:59a              1,319 xyzx.java
04/14/2003  05:59a                575 xyzy.java
04/14/2003  05:59a             15,657 xzvv.java
04/14/2003  05:59a              1,978 xzvw.java
04/14/2003  05:59a                336 xzvx.java
04/14/2003  05:59a                301 xzvy.java
04/14/2003  05:59a              5,796 xzv.java
04/14/2003  05:59a                400 xzwv.java
04/14/2003  05:59a                415 xzww.java
04/14/2003  05:59a              1,060 xzwx.java
04/14/2003  05:59a              4,149 xzwy.java
04/14/2003  05:59a                804 xzw.java
04/14/2003  05:59a                381 xzxv.java
04/14/2003  05:59a              2,667 xzxw.java
04/14/2003  05:59a                966 xzxx.java
04/14/2003  05:59a                249 xzxy.java
04/14/2003  05:59a              3,868 xzx.java
04/14/2003  05:59a              2,385 xzyv.java
04/14/2003  05:59a              1,190 xzyw.java
04/14/2003  05:59a                397 xzyx.java
04/14/2003  05:59a              1,580 xzyy.java
04/14/2003  05:59a              1,916 xzy.java
04/14/2003  05:59a              2,949 xzzv.java
04/14/2003  05:59a             17,343 xzzw.java
04/14/2003  05:59a                419 xzzx.java
04/14/2003  05:59a             12,135 xzzy.java
04/14/2003  05:59a              1,521 y.java
04/14/2003  05:59a              1,077 yv.java
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04/14/2003  05:59a                 598 yvvw.java
04/14/2003  05:59a                 301 yvvx.java
04/14/2003  05:59a                 308 yvvy.java
04/14/2003  05:59a                 464 yvv.java
04/14/2003  05:59a                 536 yvwv.java
04/14/2003  05:59a                 296 yvww.java
04/14/2003  05:59a                 296 yvwx.java
04/14/2003  05:59a                 614 yvwy.java
04/14/2003  05:59a                 901 yvw.java
04/14/2003  05:59a                 262 yvxv.java
04/14/2003  05:59a               6,608 yvxw.java
04/14/2003  05:59a                 400 yvxy.java
04/14/2003  05:59a               2,638 yvx.java
04/14/2003  05:59a                 234 yvyv.java
04/14/2003  05:59a               3,301 yvyw.java
04/14/2003  05:59a               6,718 yvyx.java
04/14/2003  05:59a                 384 yvyy.java
04/14/2003  05:59a               7,618 yvy.java
04/14/2003  05:59a                 670 yvzv.java
04/14/2003  05:59a                 529 yvzw.java
04/14/2003  05:59a               4,969 yvzx.java
04/14/2003  05:59a                 383 yvzy.java
04/14/2003  05:59a                 468 yw.java
04/14/2003  05:59a               2,774 ywvv.java
04/14/2003  05:59a               2,468 ywvw.java
04/14/2003  05:59a                 580 ywvx.java
04/14/2003  05:59a                 674 ywvy.java
04/14/2003  05:59a                 267 ywv.java
04/14/2003  05:59a                 296 ywwv.java
04/14/2003  05:59a               9,978 ywww.java
04/14/2003  05:59a                 916 ywwx.java
04/14/2003  05:59a               5,878 ywwy.java
04/14/2003  05:59a                 385 yww.java
04/14/2003  05:59a                 414 ywxv.java
04/14/2003  05:59a                 797 ywxw.java
04/14/2003  05:59a               1,031 ywxx.java
04/14/2003  05:59a               1,390 ywxy.java
04/14/2003  05:59a               3,188 ywx.java
04/14/2003  05:59a              13,329 ywyv.java
04/14/2003  05:59a                 885 ywyw.java
04/14/2003  05:59a                 475 ywyx.java
04/14/2003  05:59a                 848 ywyy.java
04/14/2003  05:59a                 847 ywy.java
04/14/2003  05:59a                 461 ywzv.java
04/14/2003  05:59a               3,589 ywzw.java
04/14/2003  05:59a              39,889 ywzx.java
04/14/2003  05:59a               1,161 ywzy.java
04/14/2003  05:59a                 386 yx.java
04/14/2003  05:59a                 757 yxvv.java
04/14/2003  05:59a              10,146 yxvw.java
04/14/2003  05:59a                 386 yxvx.java
04/14/2003  05:59a               4,370 yxvy.java
04/14/2003  05:59a               4,321 yxv.java
04/14/2003  05:59a               2,185 yxwv.java
04/14/2003  05:59a                 451 yxww.java
04/14/2003  05:59a              19,770 yxwx.java
```

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04/14/2003  05:59a             1,935 yxwy.java
04/14/2003  05:59a               366 yxw.java
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04/14/2003  05:59a               479 yxxw.java
04/14/2003  05:59a               550 yxxy.java
04/14/2003  05:59a             1,092 yxx.java
04/14/2003  05:59a             1,066 yxyv.java
04/14/2003  05:59a               243 yxyw.java
04/14/2003  05:59a             1,083 yxyx.java
04/14/2003  05:59a               627 yxyy.java
04/14/2003  05:59a             2,024 yxy.java
04/14/2003  05:59a               529 yxzv.java
04/14/2003  05:59a               377 yxzw.java
04/14/2003  05:59a               783 yxzx.java
04/14/2003  05:59a               623 yxzy.java
04/14/2003  05:59a               379 yy.java
04/14/2003  05:59a             3,432 yyvv.java
04/14/2003  05:59a               766 yyvw.java
04/14/2003  05:59a             6,857 yyvx.java
04/14/2003  05:59a             6,133 yyvy.java
04/14/2003  05:59a             1,683 yyv.java
04/14/2003  05:59a             1,732 yywv.java
04/14/2003  05:59a             2,081 yyww.java
04/14/2003  05:59a               468 yywx.java
04/14/2003  05:59a             5,652 yywy.java
04/14/2003  05:59a               365 yyw.java
04/14/2003  05:59a               473 yyxv.java
04/14/2003  05:59a             1,652 yyxw.java
04/14/2003  05:59a             2,103 yyxx.java
04/14/2003  05:59a             3,030 yyxy.java
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04/14/2003  05:59a             1,853 yyyv.java
04/14/2003  05:59a               453 yyyw.java
04/14/2003  05:59a               357 yyyx.java
04/14/2003  05:59a               433 yyyy.java
04/14/2003  05:59a             2,434 yyy.java
04/14/2003  05:59a            11,052 yyzv.java
04/14/2003  05:59a             1,073 yyzw.java
04/14/2003  05:59a             5,040 yyzx.java
04/14/2003  05:59a             1,999 yyzy.java
04/14/2003  05:59a               409 yzvv.java
04/14/2003  05:59a               392 yzvw.java
04/14/2003  05:59a               452 yzvx.java
04/14/2003  05:59a               282 yzvy.java
04/14/2003  05:59a             5,272 yzv.java
04/14/2003  05:59a             8,694 yzwv.java
04/14/2003  05:59a             1,545 yzww.java
04/14/2003  05:59a             3,165 yzwx.java
04/14/2003  05:59a             1,120 yzwy.java
04/14/2003  05:59a               293 yzw.java
04/14/2003  05:59a               777 yzxv.java
04/14/2003  05:59a               296 yzxw.java
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04/14/2003  05:59a               469 yzyv.java
04/14/2003  05:59a               387 yzyw.java
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04/14/2003  05:59a               394 yzyx.java
04/14/2003  05:59a               602 yzyy.java
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04/14/2003  05:59a               468 yzzv.java
04/14/2003  05:59a             1,426 yzzw.java
04/14/2003  05:59a               453 yzzx.java
04/14/2003  05:59a             3,093 yzzy.java
04/14/2003  05:59a               244 z.java
04/14/2003  05:59a               217 zv.java
04/14/2003  05:59a               469 zvvv.java
04/14/2003  05:59a               682 zvvw.java
04/14/2003  05:59a               388 zvvx.java
04/14/2003  05:59a               341 zvvy.java
04/14/2003  05:59a             1,056 zvv.java
04/14/2003  05:59a               574 zvwv.java
04/14/2003  05:59a               390 zvww.java
04/14/2003  05:59a               357 zvwx.java
04/14/2003  05:59a             3,529 zvwy.java
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04/14/2003  05:59a               392 zvxv.java
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04/14/2003  05:59a               262 zvyx.java
04/14/2003  05:59a               262 zvyy.java
04/14/2003  05:59a               389 zvy.java
04/14/2003  05:59a               451 zvzv.java
04/14/2003  05:59a               467 zvzw.java
04/14/2003  05:59a             2,137 zvzx.java
04/14/2003  05:59a             8,481 zvzy.java
04/14/2003  05:59a             5,379 zw.java
04/14/2003  05:59a               442 zwvv.java
04/14/2003  05:59a               389 zwvw.java
04/14/2003  05:59a               457 zwvx.java
04/14/2003  05:59a               473 zwvy.java
04/14/2003  05:59a               380 zwv.java
04/14/2003  05:59a             3,390 zwwv.java
04/14/2003  05:59a             1,119 zwww.java
04/14/2003  05:59a             5,763 zwwx.java
04/14/2003  05:59a               384 zwwy.java
04/14/2003  05:59a             1,360 zww.java
04/14/2003  05:59a               301 zwxv.java
04/14/2003  05:59a               326 zwxw.java
04/14/2003  05:59a             1,412 zwxx.java
04/14/2003  05:59a             2,661 zwxy.java
04/14/2003  05:59a               995 zwx.java
04/14/2003  05:59a               674 zwyv.java
04/14/2003  05:59a               394 zwyw.java
04/14/2003  05:59a               627 zwyx.java
04/14/2003  05:59a            24,456 zwyy.java
04/14/2003  05:59a               533 zwy.java
04/14/2003  05:59a               488 zwzv.java
04/14/2003  05:59a               387 zwzw.java
04/14/2003  05:59a             1,115 zwzx.java
04/14/2003  05:59a             1,470 zwzy.java
```

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04/14/2003  05:59a             2,898 zxvx.java
04/14/2003  05:59a               467 zxvy.java
04/14/2003  05:59a               350 zxv.java
04/14/2003  05:59a               815 zxwv.java
04/14/2003  05:59a             1,332 zxww.java
04/14/2003  05:59a               299 zxwx.java
04/14/2003  05:59a               239 zxwy.java
04/14/2003  05:59a               394 zxw.java
04/14/2003  05:59a             1,881 zxxv.java
04/14/2003  05:59a               312 zxxw.java
04/14/2003  05:59a               376 zxxy.java
04/14/2003  05:59a             5,969 zxx.java
04/14/2003  05:59a               919 zxyv.java
04/14/2003  05:59a               296 zxyw.java
04/14/2003  05:59a             7,539 zxyx.java
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04/14/2003  05:59a             1,318 zxy.java
04/14/2003  05:59a               999 zxzv.java
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04/14/2003  05:59a               551 zxzx.java
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04/14/2003  05:59a             2,739 zyvv.java
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04/14/2003  05:59a             5,224 zyvy.java
04/14/2003  05:59a             1,065 zyv.java
04/14/2003  05:59a               830 zywv.java
04/14/2003  05:59a             1,031 zyww.java
04/14/2003  05:59a            11,192 zywx.java
04/14/2003  05:59a             6,218 zywy.java
04/14/2003  05:59a               432 zyw.java
04/14/2003  05:59a               611 zyxv.java
04/14/2003  05:59a               608 zyxw.java
04/14/2003  05:59a               660 zyxx.java
04/14/2003  05:59a               396 zyxy.java
04/14/2003  05:59a             3,180 zyx.java
04/14/2003  05:59a               773 zyyv.java
04/14/2003  05:59a               451 zyyw.java
04/14/2003  05:59a             3,069 zyyx.java
04/14/2003  05:59a               461 zyyy.java
04/14/2003  05:59a               232 zyy.java
04/14/2003  05:59a               296 zyzv.java
04/14/2003  05:59a               579 zyzw.java
04/14/2003  05:59a               221 zyzx.java
04/14/2003  05:59a               266 zyzy.java
04/14/2003  05:59a               990 zzvv.java
04/14/2003  05:59a               696 zzvw.java
04/14/2003  05:59a               227 zzvx.java
04/14/2003  05:59a               301 zzvy.java
04/14/2003  05:59a               502 zzv.java
04/14/2003  05:59a               308 zzwv.java
04/14/2003  05:59a             1,436 zzww.java
04/14/2003  05:59a               221 zzwx.java
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04/14/2003  05:59a                436 zzw.java
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04/14/2003  05:59a                447 zzxw.java
04/14/2003  05:59a              2,829 zzxx.java
04/14/2003  05:59a              1,152 zzxy.java
04/14/2003  05:59a                828 zzx.java
04/14/2003  05:59a              1,303 zzyv.java
04/14/2003  05:59a              1,545 zzyw.java
04/14/2003  05:59a                452 zzyx.java
04/14/2003  05:59a              1,533 zzyy.java
04/14/2003  05:59a                406 zzy.java
04/14/2003  05:59a                801 zzzv.java
04/14/2003  05:59a                448 zzzw.java
04/14/2003  05:59a              4,683 zzzx.java
04/14/2003  05:59a              3,601 zzzy.java
             613 File(s)      1,714,117 bytes

     Total Files Listed:
            1088 File(s)      4,979,436 bytes
              27 Dir(s)               0 bytes free
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US03/11809

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : A61B 5/00
US CL : 600/300

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
U.S. : 600/300-301, 481, 529; 128/903-904, 920-921, 923; 705/2-4; 709/200, 203, 217; 340/539.1, 539.11, 539.12, 573.1

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
WEST 2.1 including PUS search

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y, P	US 6,544,173 B2 (WEST et al) 08 April 2003, see column 1, lines 18-65, figures 2 and 4	1
Y, P	US 6,440,068 B1 (BROWN et al) 27 August 2002, see column 3, lines 13-67, column 4, lines 1-67, and column 5, lines 1-67, and figure 2	1
Y, P	US 6,401,085 B1 (GERSHMAN et al) 04 June 2002, see column 68, lines 44-67, column 69, lines 1-28, column 70, lines 1-18, and figure 1a	1
Y	US 6,294,999 B1 (YARIN et al) 25 September 2001, see column 5, lines 22-64, column 9, lines 1-62, and figure 2	1

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

* Special categories of cited documents:

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

"E" earlier application or patent published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

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

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

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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

"&" document member of the same patent family

Date of the actual completion of the international search
27 July 2003 (27.07.2003)

Date of mailing of the international search report
30 SEP 2003

Name and mailing address of the ISA/US
Mail Stop PCT, Attn: ISA/US
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
Facsimile No. (703)305-3230

Authorized officer
Michael Astorino Diane Russell for

Telephone No. (703) 306-5648

Form PCT/ISA/210 (second sheet) (July 1998)

专利名称(译)	用于远程监控患者状况的方法和设备		
公开(公告)号	EP1499233A1	公开(公告)日	2005-01-26
申请号	EP2003719793	申请日	2003-04-15
[标]申请(专利权)人(译)	CAREMATIX		
申请(专利权)人(译)	CAREMATIX INC.		
当前申请(专利权)人(译)	CAREMATIX INC.		
[标]发明人	KHANUJA SUKHWANT SINGH GARG SANDEEP SINGH IRWIN PREET		
发明人	KHANUJA, SUKHWANT, SINGH GARG, SANDEEP SINGH, IRWIN, PREET		
IPC分类号	A61B5/00 A61B5/0205 A61B5/021 A61B5/087 A61B5/117 G06F19/00 H04M11/00		
CPC分类号	A61B5/0002 A61B5/02055 A61B5/021 A61B5/087 A61B5/1455 A61B5/411 G06Q40/08 G16H10/40 G16H15/00 G16H40/63 G16H80/00 H04L67/025 H04L67/28 H04L67/2838 H04M11/007 H04Q9/00 H04Q2209/40 H04Q2209/823 Y10S128/903 Y10S128/904 Y10S128/905 Y10S128/92		
优先权	60/372894 2002-04-16 US		
其他公开文献	EP1499233A4		
外部链接	Espacenet		

摘要(译)

患者监测系统技术领域本发明涉及一种患者监测系统（30），其相对于已知系统提供增强的功能能力，并且在患者佩戴的患者监测装置（32）和本地集线器（34）之间提供无线通信链路。根据本发明的患者监测系统（30）适于监测各种患者的生理特征，例如血压，脉搏率，血糖，体重，脉搏血氧饱和度等。来自患者监测设备（32）的数据被无线传输到本地集线器（34），本地集线器（34）又被配置为自动地将数据传输到远程服务器（38），例如，通过公共或私人通信。网络。服务器可以被配置为门户网站，以选择性地允许指定的第三方（例如医生，临床医生，亲属和患者自己）访问这样的患者生理数据。该系统可以提供相对于已知系统的增强功能，并且允许选择性地生成生理数据的警报和趋势。