US008487774B2

(12) **United States Patent**
Reeder et al.

(10) **Patent No.: US 8,487,774 B2**
(45) **Date of Patent: Jul. 16, 2013**

(54) **SYSTEM FOR MONITORING CAREGIVERS AND EQUIPMENT**

(75) Inventors: **Ryan A. Reeder**, Brookville, IN (US); **Kenneth L. Kramer**, Tai Po (HK); **William L. Jacques**, Mount Pleasant, SC (US); **Carl W. Riley**, Milan, IN (US); **Richard J. Schuman**, Cary, NC (US)

(73) Assignee: **Hill-Rom Services, Inc.**, Batesville, IN (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **13/599,110**

(22) Filed: **Aug. 30, 2012**

(65) **Prior Publication Data**

US 2012/0319836 A1 Dec. 20, 2012

Related U.S. Application Data

(63) Continuation of application No. 13/238,899, filed on Sep. 21, 2011, now Pat. No. 8,258,965, and a continuation of application No. 12/258,058, filed on Oct. 24, 2008, now Pat. No. 8,026,821, and a continuation of application No. 11/075,979, filed on Mar. 9, 2005, now Pat. No. 7,443,302, and a continuation of application No. 09/849,688, filed on May 4, 2001, now Pat. No. 6,876,303.

(60) Provisional application No. 60/202,283, filed on May 5, 2000, provisional application No. 60/202,284, filed on May 5, 2000, provisional application No. 60/229,136, filed on Aug. 30, 2000.

(51) **Int. Cl.**
G08B 23/00 (2006.01)

(52) **U.S. Cl.**
USPC **340/573.1**; 340/539.12; 340/286.07; 340/825.49; 340/825.69; 128/903; 128/904; 600/300; 600/301

(58) **Field of Classification Search**
USPC 340/573.1, 573.4, 539.12, 539.13, 340/286.07, 825.49, 825.69, 825.72; 128/903, 128/904, 920, 921; 600/300, 301
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,850,040	A		7/1989	Teich et al.
5,003,984	A		4/1991	Muraki et al.
5,036,852	A		8/1991	Leishman
5,228,449	A		7/1993	Christ et al.
5,291,399	A		3/1994	Chaco et al.
5,319,363	A		6/1994	Welch et al.
5,394,882	A		3/1995	Mawhinney et al.
5,415,167	A		5/1995	Wilk et al.
5,417,222	A	*	5/1995	Dempsey et al. 600/509
5,511,553	A		4/1996	Segalowitz et al.
5,515,426	A		5/1996	Yacenda et al.

(Continued)

OTHER PUBLICATIONS

"Cricket v2 User Manual," MIT Computer Science and Artificial Intelligence Lab, Jan. 2005.

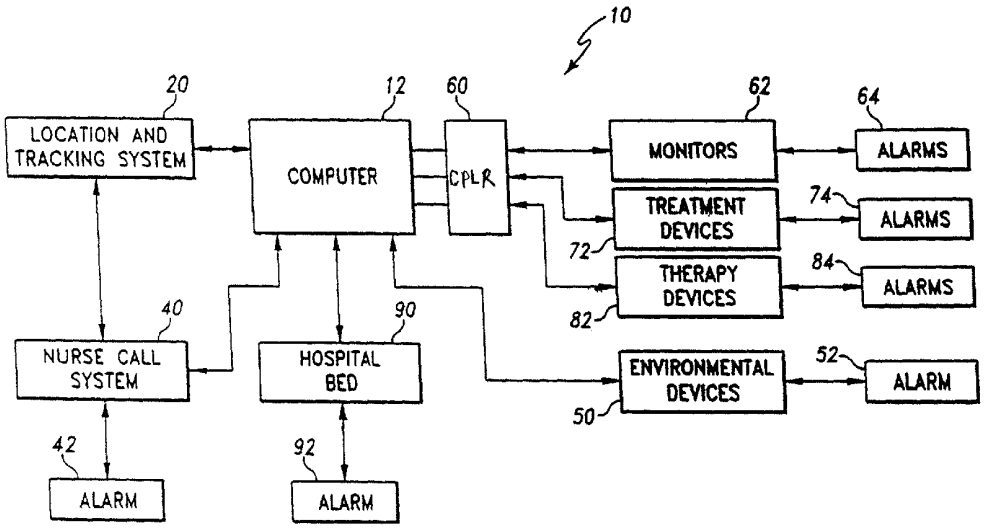
(Continued)

Primary Examiner — Hung T. Nguyen
(74) *Attorney, Agent, or Firm* — Barnes & Thornburg LLP

(57) **ABSTRACT**

A hospital monitoring system for monitoring hospital personnel, a plurality of patient locations for patients, and associated devices is configured to control the associated devices based on the presence of hospital personnel or alarms.

20 Claims, 15 Drawing Sheets



U.S. PATENT DOCUMENTS

5,534,851	A *	7/1996	Russek	340/573.4
5,537,095	A	7/1996	Dick et al.	
5,544,661	A	8/1996	Davis et al.	
5,561,412	A	10/1996	Novak et al.	
5,579,775	A	12/1996	Dempsey et al.	
5,594,786	A	1/1997	Chaco et al.	
5,628,324	A	5/1997	Sarbach	
5,664,270	A *	9/1997	Bell et al.	5/600
5,678,562	A	10/1997	Sellers et al.	
5,687,771	A	11/1997	Clough et al.	
5,689,229	A	11/1997	Chaco et al.	
5,699,038	A	12/1997	Ulrich et al.	
5,712,795	A	1/1998	Layman et al.	
5,713,856	A	2/1998	Eggers et al.	
5,719,761	A	2/1998	Gatti et al.	
5,724,025	A	3/1998	Tavori	
5,738,102	A	4/1998	Lemelson	
5,772,599	A	6/1998	Nevo et al.	
5,781,442	A	7/1998	Engleson et al.	
5,800,387	A	9/1998	Duffy et al.	
5,808,552	A	9/1998	Wiley et al.	
5,822,418	A	10/1998	Yacenda et al.	
5,822,544	A	10/1998	Chaco et al.	
5,825,283	A	10/1998	Camhi et al.	
5,836,910	A	11/1998	Duffy et al.	
5,838,223	A	11/1998	Gallant et al.	
5,862,803	A	1/1999	Besson et al.	
5,867,821	A	2/1999	Ballantyne et al.	
5,873,369	A	2/1999	Laniado et al.	
5,919,141	A	7/1999	Money et al.	
5,941,846	A	8/1999	Duffy et al.	
5,944,659	A	8/1999	Flach et al.	
5,957,854	A	9/1999	Besson et al.	
5,990,866	A	11/1999	Yollin et al.	
6,009,333	A	12/1999	Chaco et al.	
6,014,346	A	1/2000	Malone et al.	
6,028,519	A	2/2000	Dessureau et al.	
6,038,469	A	3/2000	Karlsson et al.	
6,044,283	A	3/2000	Fein et al.	
6,044,382	A	3/2000	Martino et al.	
6,047,203	A	4/2000	Sackner et al.	
6,057,758	A	5/2000	Dempsey et al.	
6,067,019	A	5/2000	Scott et al.	
6,074,345	A	6/2000	Van Oostrom et al.	
6,078,261	A	6/2000	Davsko et al.	
6,080,106	A	6/2000	Lloyd et al.	
6,093,146	A	7/2000	Filangeri	
6,125,350	A	9/2000	Dirbas et al.	
6,132,371	A	10/2000	Dempsey et al.	
6,135,949	A	10/2000	Russo et al.	
6,147,592	A	11/2000	Ulrich et al.	
6,147,618	A	11/2000	Halleck et al.	
6,150,951	A	11/2000	Olejniczak	
6,159,147	A	12/2000	Lichter et al.	
6,160,478	A	12/2000	Jacobsen et al.	
6,167,258	A	12/2000	Schmidt et al.	
6,171,264	B1	1/2001	Bader	
6,186,962	B1	2/2001	Lloyd et al.	
6,198,394	B1	3/2001	Jacobsen et al.	
6,213,942	B1	4/2001	Flach et al.	
6,259,355	B1	7/2001	Chaco et al.	
6,270,457	B1	8/2001	Bardy	
6,277,080	B1	8/2001	Nissila et al.	
6,289,238	B1	9/2001	Besson et al.	
6,304,774	B1	10/2001	Gorman	
6,336,900	B1	1/2002	Alleckson et al.	
6,336,903	B1	1/2002	Bardy	
6,368,284	B1	4/2002	Bardy	
6,398,727	B1	6/2002	Bui et al.	
6,398,728	B1	6/2002	Bardy	
6,402,691	B1	6/2002	Peddicord et al.	
6,406,426	B1	6/2002	Reuss et al.	
6,407,335	B1	6/2002	Franklin-Lees et al.	
6,411,840	B1	6/2002	Bardy	
6,416,471	B1	7/2002	Kumar et al.	
6,441,747	B1	8/2002	Khair et al.	
6,443,890	B1	9/2002	Schulze et al.	
6,450,953	B1	9/2002	Place et al.	
6,475,153	B1	11/2002	Khair et al.	
6,493,747	B2	12/2002	Simmon et al.	
6,494,829	B1	12/2002	New, Jr. et al.	
6,496,705	B1	12/2002	Ng et al.	
6,497,656	B1	12/2002	Evans et al.	
6,517,497	B2	2/2003	Rymut et al.	
6,533,729	B1	3/2003	Khair et al.	
6,540,686	B2	4/2003	Heikkilä et al.	
6,544,173	B2	4/2003	West et al.	
6,544,174	B2	4/2003	West et al.	
6,551,252	B2	4/2003	Sackner et al.	
6,559,620	B2	5/2003	Zhou et al.	
6,569,094	B2	5/2003	Suzuki et al.	
6,575,902	B1	6/2003	Burton	
6,577,893	B1	6/2003	Besson et al.	
6,579,231	B1	6/2003	Phipps	
6,589,170	B1	7/2003	Flach et al.	
6,593,528	B2	7/2003	Franklin-Lees et al.	
6,594,511	B2	7/2003	Stone et al.	
6,595,929	B2	7/2003	Stivoric et al.	
6,600,421	B2 *	7/2003	Freeman	340/573.1
6,602,191	B2	8/2003	Quy	
6,603,401	B1	8/2003	Ueyama	
6,605,038	B1	8/2003	Teller et al.	
6,611,705	B2	8/2003	Hopman et al.	
6,612,984	B1	9/2003	Kerr, II	
6,616,606	B1	9/2003	Petersen et al.	
6,640,246	B1	10/2003	Gary, Jr. et al.	
6,659,947	B1	12/2003	Carter et al.	
6,669,630	B1	12/2003	Joliat et al.	
6,671,563	B1	12/2003	Engelson et al.	
6,694,180	B1	2/2004	Boesen	
6,723,046	B2	4/2004	Lichtenstein et al.	
6,731,989	B2	5/2004	Engleson et al.	
6,736,759	B1	5/2004	Stubbs et al.	
6,740,033	B1	5/2004	Olejniczak et al.	
6,748,250	B1	6/2004	Berman et al.	
6,749,566	B2	6/2004	Russ	
6,758,812	B2	7/2004	Lang	
6,773,396	B2	8/2004	Flach et al.	
6,817,979	B2	11/2004	Nihtilä	
6,819,247	B2	11/2004	Birnbach et al.	
6,823,036	B1	11/2004	Chen	
6,840,904	B2	1/2005	Goldberg	
6,870,466	B2	3/2005	Rust	
6,871,211	B2	3/2005	Labounty et al.	
6,875,174	B2	4/2005	Braun et al.	
6,876,303	B2	4/2005	Reeder et al.	
6,893,396	B2	5/2005	Schulze et al.	
6,897,788	B2	5/2005	Khair et al.	
6,915,170	B2	7/2005	Engleson et al.	
6,937,150	B2	8/2005	Medema et al.	
6,942,616	B2	9/2005	Kerr, II	
6,984,297	B2	1/2006	Nisch et al.	
6,987,965	B2	1/2006	Ng et al.	
6,988,989	B2	1/2006	Weiner et al.	
7,002,468	B2	2/2006	Eveland et al.	
7,004,907	B2	2/2006	Banet et al.	
7,010,337	B2	3/2006	Furnary et al.	
7,020,508	B2	3/2006	Stivoric et al.	
7,029,455	B2	4/2006	Flaherty	
7,053,767	B2	5/2006	Petite et al.	
7,053,831	B2	5/2006	Dempsey et al.	
7,088,233	B2	8/2006	Menard	
7,099,895	B2	8/2006	Dempsey	
7,103,407	B2	9/2006	Hjelt et al.	
7,104,955	B2	9/2006	Bardy	
7,107,106	B2	9/2006	Engleson et al.	
7,117,041	B2	10/2006	Engleson et al.	
7,123,149	B2	10/2006	Nowak et al.	
7,127,261	B2	10/2006	Van Erlach	
7,129,836	B2	10/2006	Lawson et al.	
7,130,396	B2	10/2006	Rogers et al.	
7,138,902	B2	11/2006	Menard	
7,153,262	B2	12/2006	Stivoric et al.	
7,153,263	B2	12/2006	Carter et al.	
7,154,398	B2	12/2006	Chen et al.	
7,156,807	B2	1/2007	Carter et al.	
7,171,166	B2	1/2007	Ng et al.	

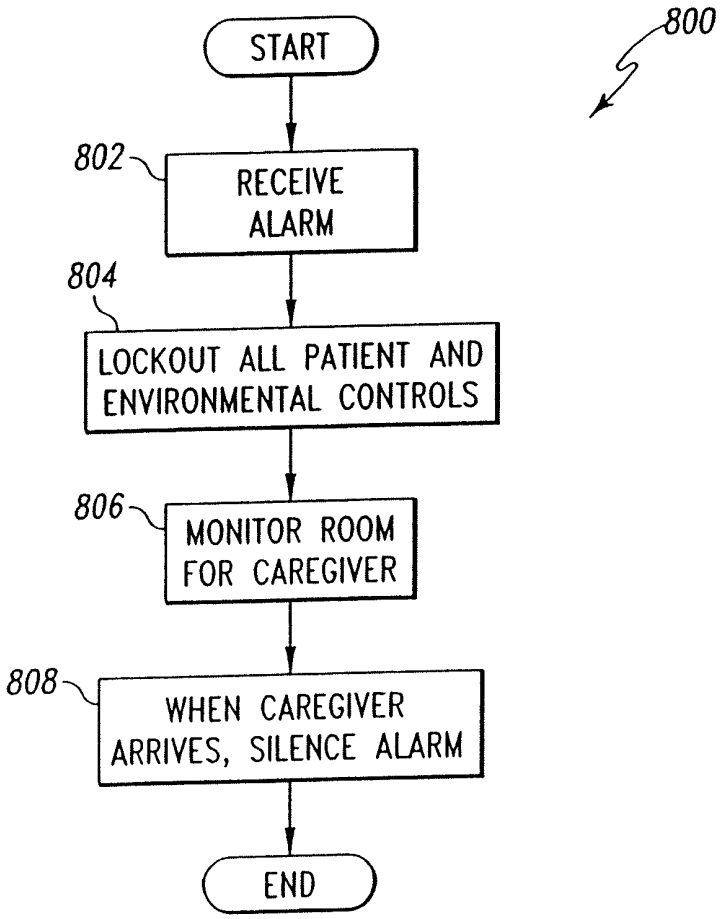

800
START
802
RECEIVE ALARM
804
LOCKOUT ALL PATIENT AND ENVIRONMENTAL CONTROLS
806
MONITOR ROOM FOR CAREGIVER
808
WHEN CAREGIVER ARRIVES, SILENCE ALARM
END

Fig. 8

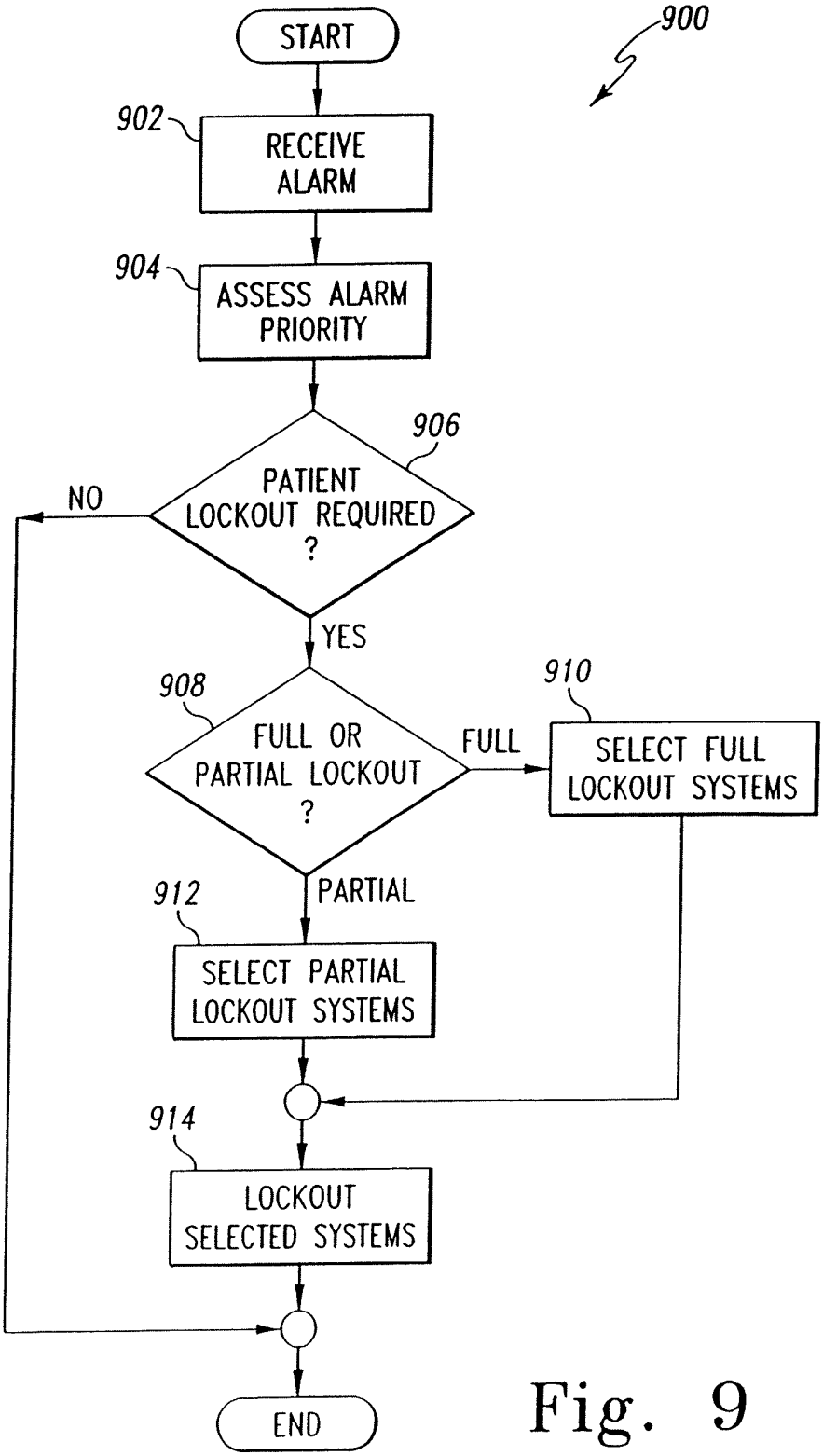

900
START
902
RECEIVE ALARM
904
ASSESS ALARM PRIORITY
906
PATIENT LOCKOUT REQUIRED ?
NO
YES
908
FULL OR PARTIAL LOCKOUT ?
FULL
910
SELECT FULL LOCKOUT SYSTEMS
PARTIAL
912
SELECT PARTIAL LOCKOUT SYSTEMS
914
LOCKOUT SELECTED SYSTEMS
END

Fig. 9

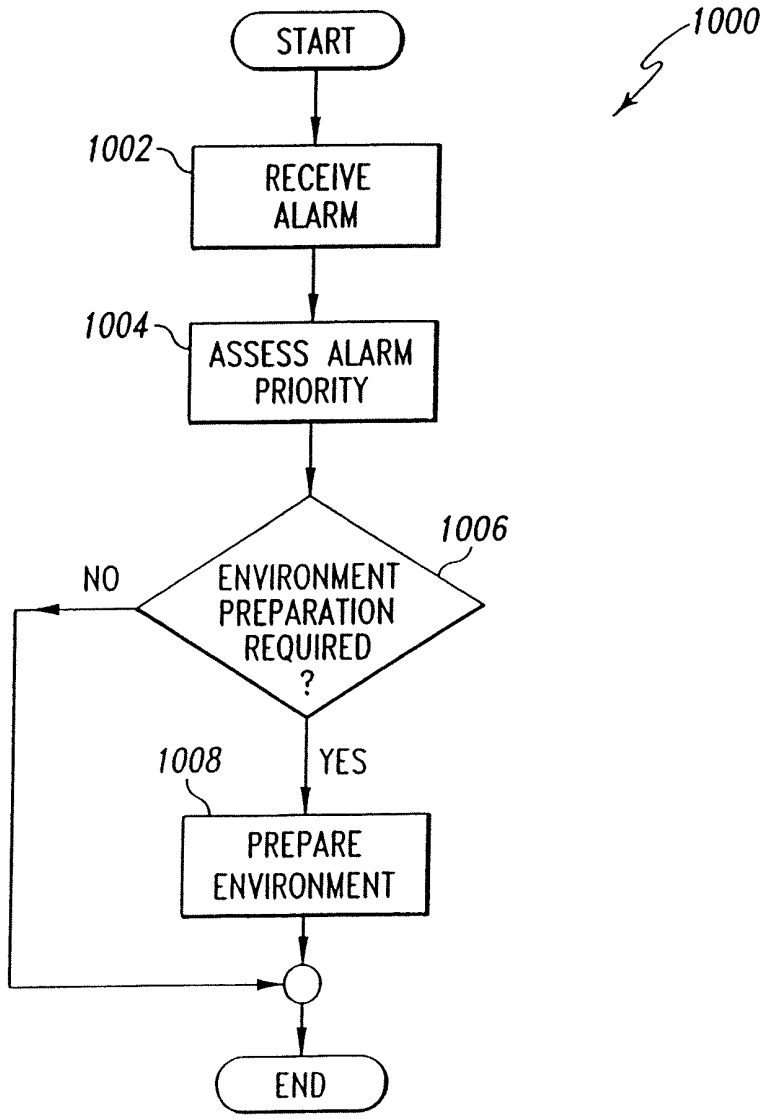

1000
START
1002
RECEIVE ALARM
1004
ASSESS ALARM PRIORITY
1006
ENVIRONMENT PREPARATION REQUIRED ?
NO
YES
1008
PREPARE ENVIRONMENT
END

Fig. 10

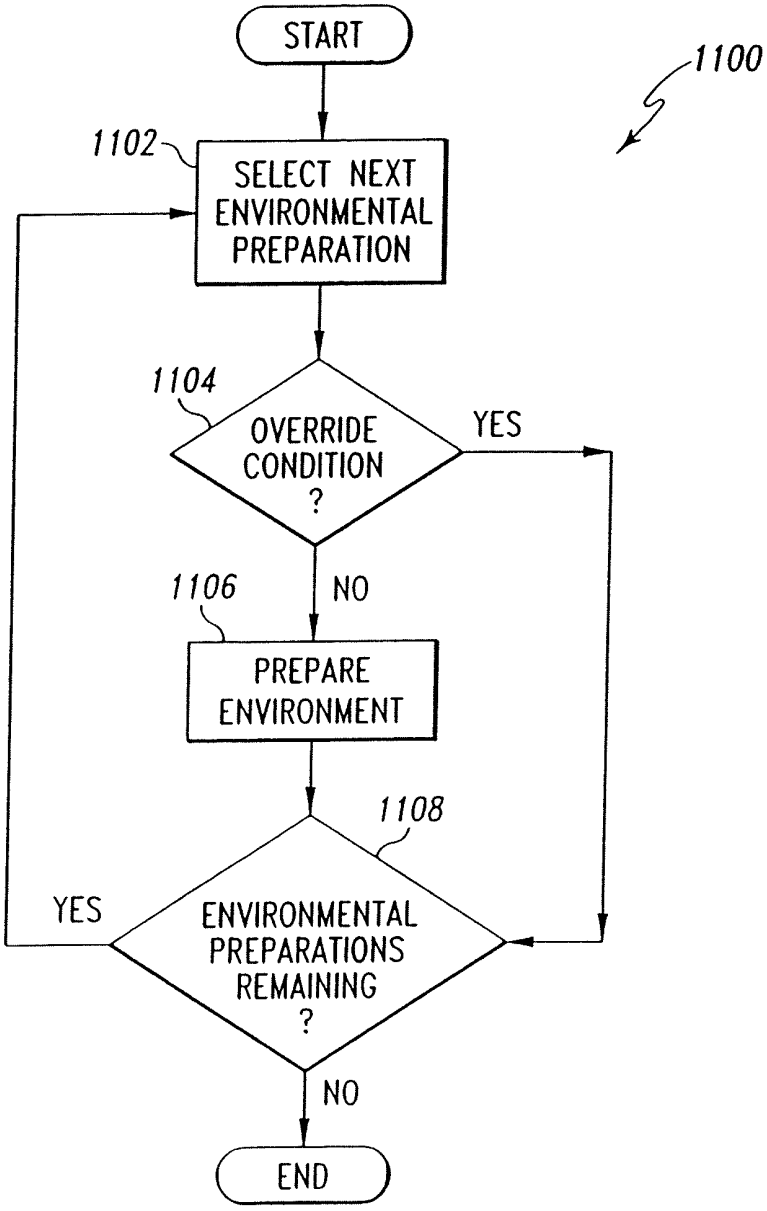

START
1100
1102
SELECT NEXT ENVIRONMENTAL PREPARATION
1104
OVERRIDE CONDITION ?
YES
NO
1106
PREPARE ENVIRONMENT
1108
ENVIRONMENTAL PREPARATIONS REMAINING ?
YES
NO
END

Fig. 11

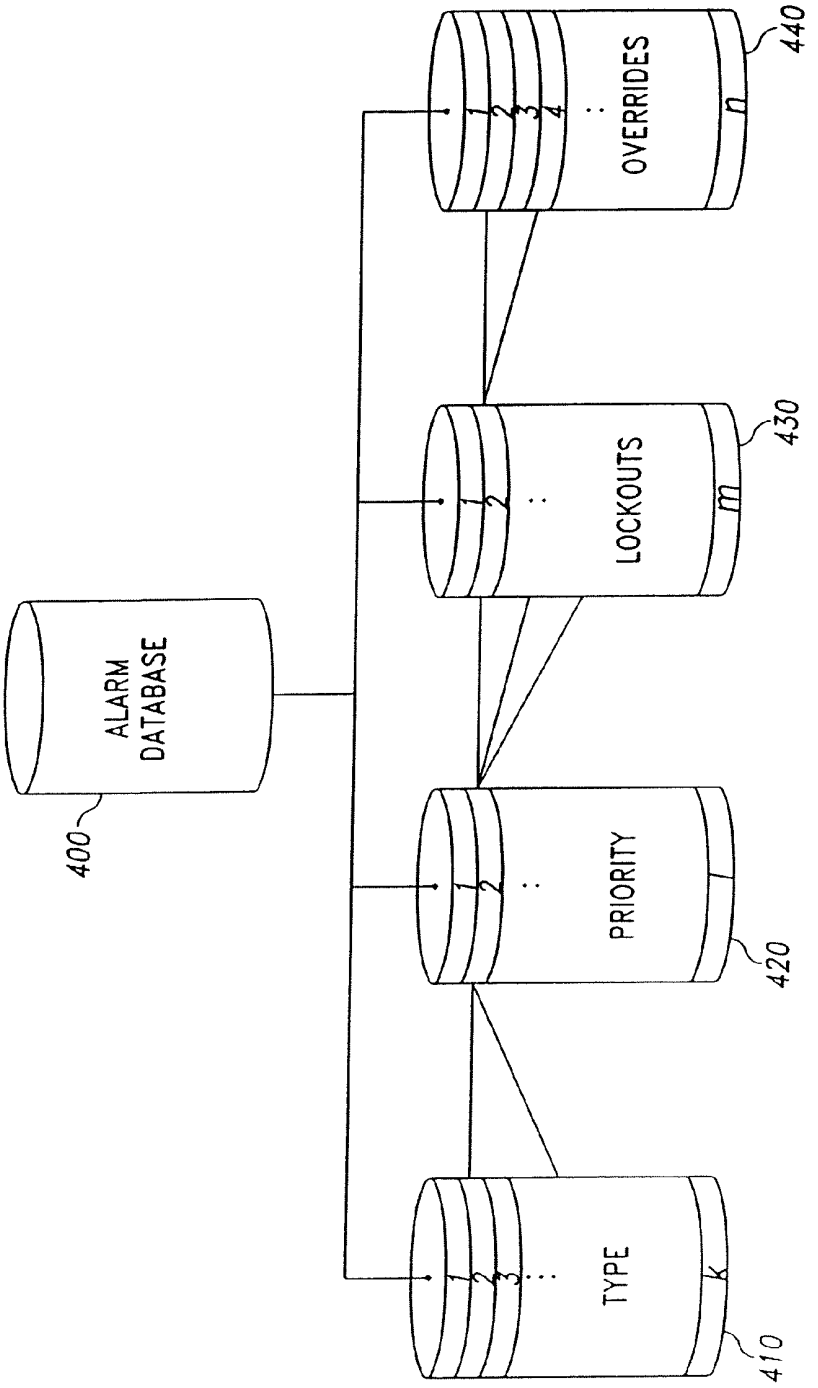

ALARM DATABASE
400
TYPE
410
PRIORITY
420
LOCKOUTS
430
OVERRIDES
440

Fig. 12

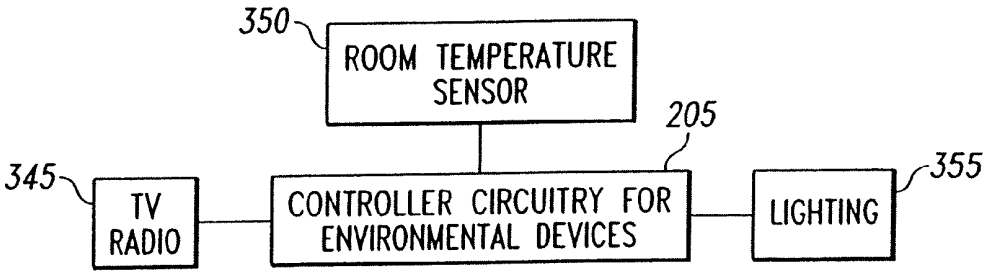

350
ROOM TEMPERATURE SENSOR
205
345
TV RADIO
CONTROLLER CIRCUITRY FOR ENVIRONMENTAL DEVICES
LIGHTING
355

Fig. 13

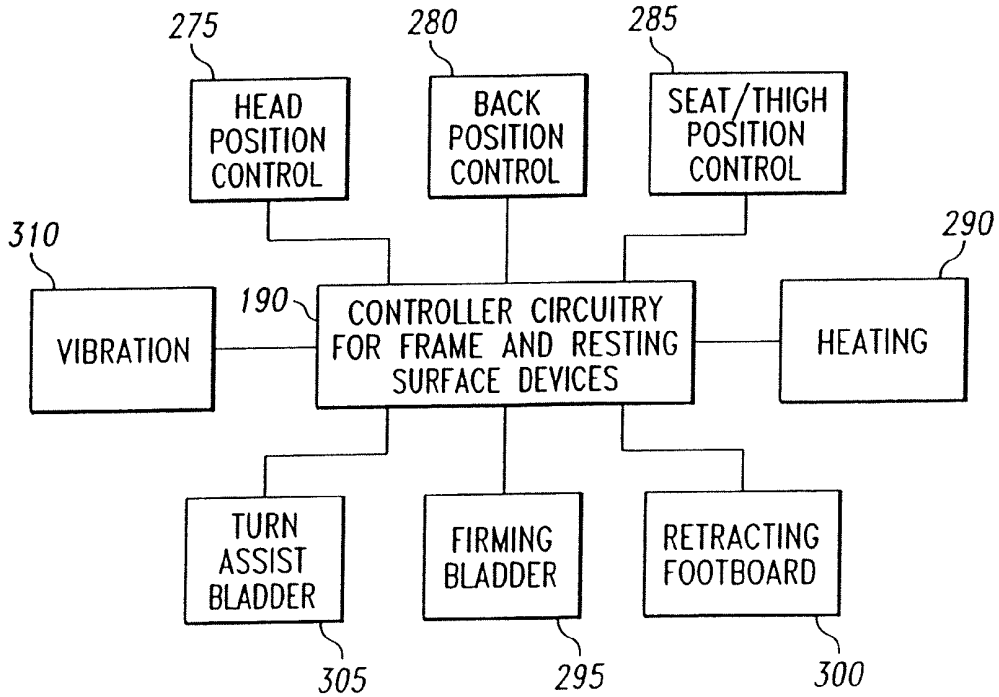

275
280
285
HEAD POSITION CONTROL
BACK POSITION CONTROL
SEAT/THIGH POSITION CONTROL
310
290
190
VIBRATION
CONTROLLER CIRCUITRY FOR FRAME AND RESTING SURFACE DEVICES
HEATING
TURN ASSIST BLADDER
FIRMING BLADDER
RETRACTING FOOTBOARD
305
295
300

Fig. 14

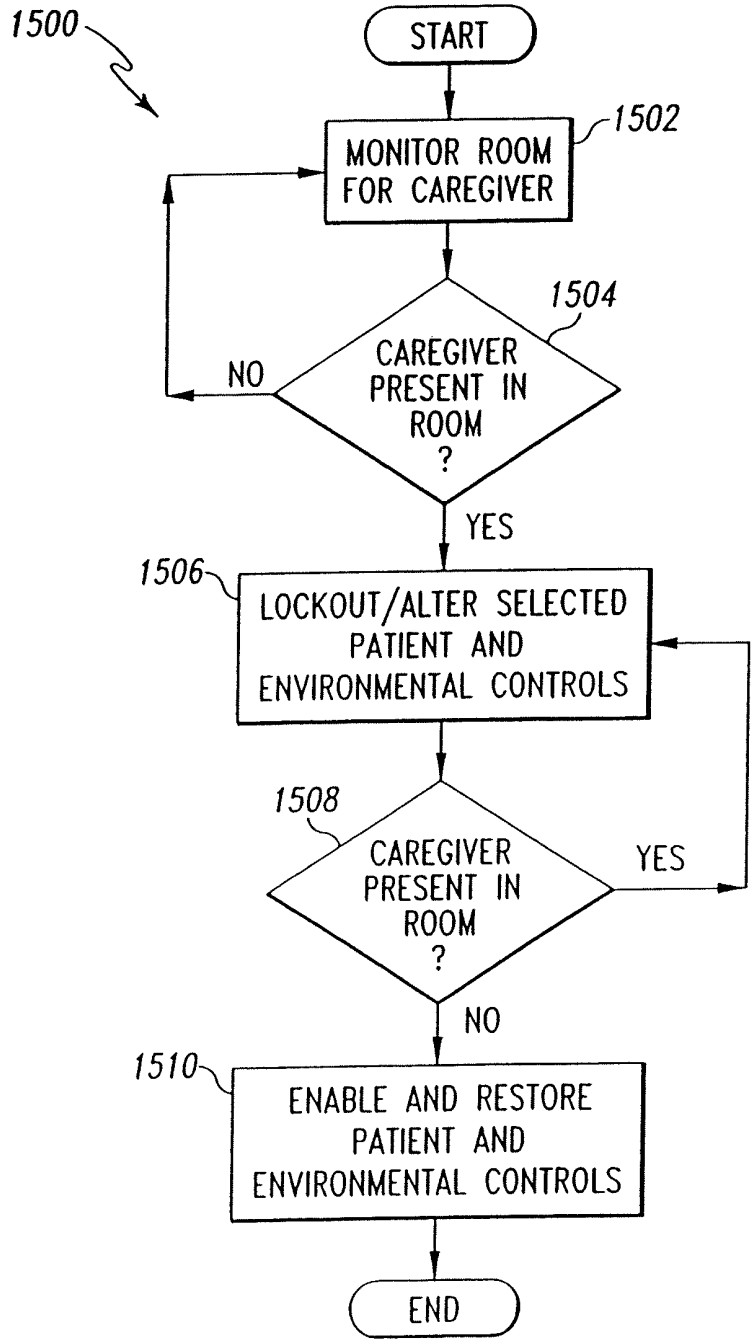

1500
START
MONITOR ROOM FOR CAREGIVER
1502
CAREGIVER PRESENT IN ROOM ?
1504
NO
YES
1506
LOCKOUT/ALTER SELECTED PATIENT AND ENVIRONMENTAL CONTROLS
1508
CAREGIVER PRESENT IN ROOM ?
YES
NO
1510
ENABLE AND RESTORE PATIENT AND ENVIRONMENTAL CONTROLS
END

Fig. 15

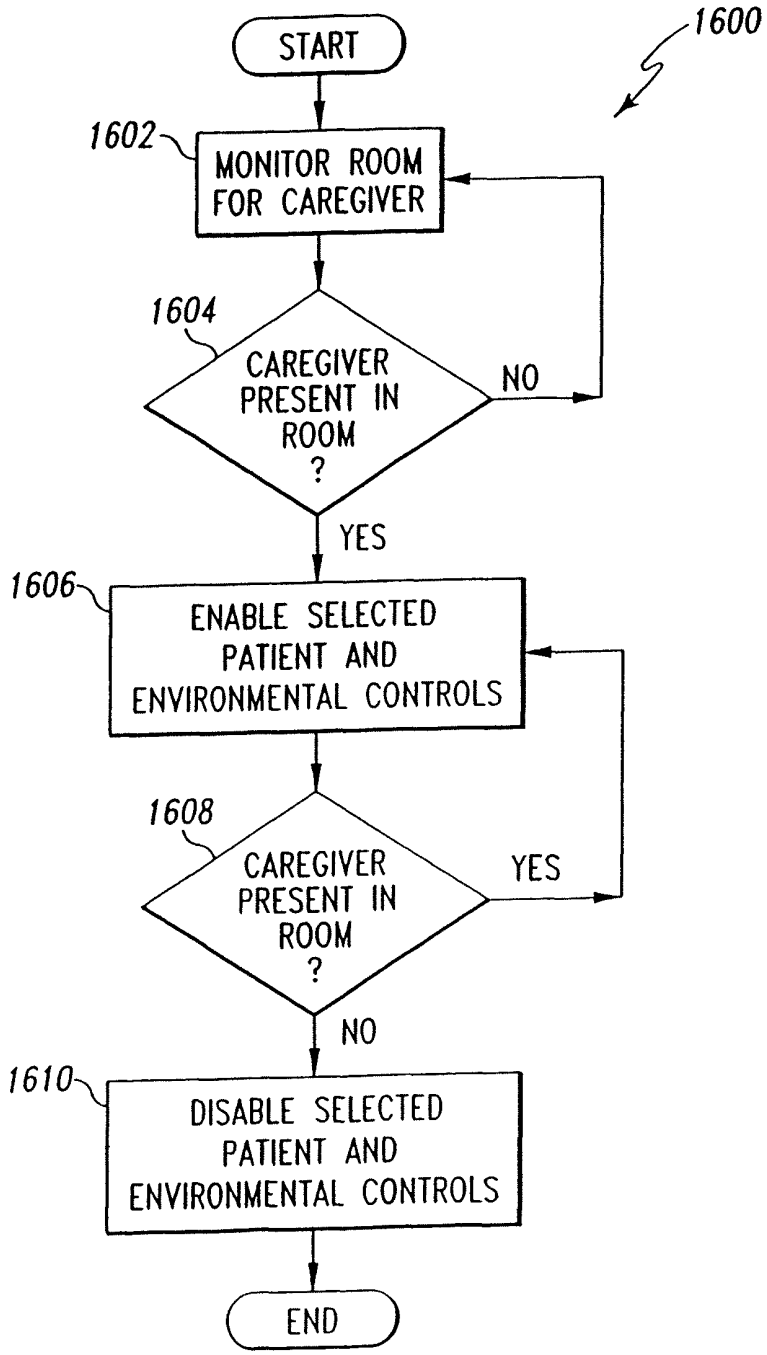

1600
START
1602
MONITOR ROOM FOR CAREGIVER
1604
CAREGIVER PRESENT IN ROOM ?
NO
YES
1606
ENABLE SELECTED PATIENT AND ENVIRONMENTAL CONTROLS
1608
CAREGIVER PRESENT IN ROOM ?
YES
NO
1610
DISABLE SELECTED PATIENT AND ENVIRONMENTAL CONTROLS
END

Fig. 16

SYSTEM FOR MONITORING CAREGIVERS AND EQUIPMENT

REFERENCE TO PRIORITY APPLICATIONS

This application is a continuation of prior application Ser. No. 13/238,899, filed Sep. 21, 2011, projected U.S. Pat. No. 8,258,965, which is a continuation of prior application Ser. No. 12/258,058, filed Oct. 24, 2008, now U.S. Pat. No. 8,026,821, which is a continuation of prior application Ser. No. 11/075,979, filed Mar. 9, 2005, now U.S. Pat. No. 7,443,302, which is a continuation of prior application Ser. No. 09/849,688, filed May 4, 2001, now U.S. Pat. No. 6,876,303, all of which are hereby incorporated herein by reference. This application also claims the benefit of U.S. Provisional Application Ser. No. 60/202,283, entitled "Patient Point of Care Computer System," filed May 5, 2000; U.S. Provisional Application No. 60/202,284, entitled "Remote Control for a Hospital Bed," filed May 5, 2000; and U.S. Provisional Application No. 60/229,136, entitled "Patient Point of Care Computer System," filed Aug. 30, 2000, all of which are hereby incorporated herein by reference.

CROSS REFERENCE TO RELATED APPLICATIONS

The disclosures of related U.S. Nonprovisional application Ser. No. 09/849,580, entitled "Patient Point of Care Computer System", filed May 4, 2001, and U.S. Nonprovisional application Ser. No. 09/848,941, entitled "Remote Control for a Hospital Bed" filed May 4, 2001 are incorporated herein by reference.

BACKGROUND AND SUMMARY OF THE INVENTION

The present invention relates to a hospital monitoring system, and more particularly, to hospital monitoring system for monitoring hospital personnel, a plurality of patient locations for patients, and associated devices.

Hospital staff, including doctors, nurses, physician assistants, orderlies, etc., provide patient care while the patient is undergoing treatment and/or therapy during a hospital visit. A number of systems have been developed to facilitate providing patient care, such as personnel locating systems, nurse call systems, bed status information systems, and patient monitoring devices. Details of such systems are disclosed in U.S. Pat. No. 6,067,019 (Bed Exit Detection Apparatus); U.S. Pat. No. 5,838,223 (Patient/Nurse Call System); U.S. Pat. No. 5,808,552 (Patient Detection System for a Patient-Support Device); U.S. Pat. No. 5,699,038 (Bed Status Information System for Hospital Beds); U.S. Pat. No. 5,561,412 (Patient/Nurse Call System); and U.S. Pat. No. 5,537,095 (Incontinence Detection Device), the disclosures of which are incorporated herein by reference. Additionally, co-pending U.S. Nonprovisional application Ser. No. 09/849,580, filed May 4, 2001, entitled "Patient Point of Care Computer System," and Ser. No. 09/848,941, filed May 4, 2001, entitled "Remote Control For a Hospital Bed," the disclosures of which are incorporated herein by reference, also disclose systems that have been developed to facilitate providing patient care.

The systems disclosed above facilitate various patient alarms, such as a patient exiting a bed, an incontinence event, or an emergency call for a caregiver. Typically, a caregiver will enter the patient's room when responding to an alarm. However, the caregiver often must manually silence the alarm, adjust the room lighting, or shut off a television or radio prior to attending to the patient. This manual preparation of the working environment may distract the caregiver and further increases response time to critical alarms. The disclosure is directed toward the automatic silencing of such alarms and/or preparing the working environment when a responsive caregiver enters the patient's room. Further, the disclosure is directed toward preparing the working environment when an alarm is received. Further still, the disclosure is directed toward preparing the working environment when an alarm is received, subject to environmental and patient control overrides depending on the nature of the alarm and time of the alarm.

The system disclosed also provides for automatic lockouts of patient and environmental controls when the caregiver enters the room, regardless of the presence of an alarm. As a caregiver makes his or her rounds, the caregiver may need to tend to the patient's needs. Often a caregiver must ensure that patient activated controls are locked out during this time, as the patient may inadvertently activate a control and interfere with the caregiver's duties. Also disclosed is a system that provides for the automatic enablement of patient controls, bed controls, and/or environmental controls when a caregiver is in the room.

One illustrative embodiment prevents the status of bed lockouts from being changed without an authorized caregiver within the room. When the caregiver enters the room, the system receives a caregiver identification signal from a caregiver badge. After the system authenticates the identification signal, the system then permits the bed lockout status to be changed. The bed lockout controls prevent the patient on bed from actuating certain controls. These lockouts are typically actuated by pressing a button or a combination of two or more buttons on the bed to lock out various bed controls, environmental controls, or other functions.

Another embodiment is designed for use with beds which are movable from a generally flat bed position to a chair position. In this embodiment of the present invention, the bed is unable to move to a chair position unless an authorized caregiver is located within the room. Again, the system must receive and authenticate the identification signal from caregiver badge before the bed is permitted to move to the chair position.

In yet another embodiment, the status of patient environmental controls adjacent a bed is automatically altered when the caregiver enters the room. For example, in one embodiment the sound on a TV/radio device is muted and specific light sources are activated when the caregiver enters the room. A system receives the caregiver identification signal. After the system authenticates the identification signal, the system instructs the TV/radio device to mute all sound and the light source to activate specific lights. In another embodiment, the system locks out one or more of the environmental controls within the room once the control unit authenticates the identification signal from the caregiver badge. Therefore, the patient can no longer control the environmental functions such as, for example, the radio, television or lighting when an authorized caregiver is in the room.

According to the invention, a hospital monitoring system for monitoring hospital personnel, a plurality of patient locations for patients, and associated devices is disclosed. The system comprises a plurality of transmitters carried by hospital personnel, each transmitter periodically transmitting a transmitter signal unique to that transmitter; a plurality of receivers, each receiver corresponding to a patient location, the receivers receiving the transmitter signals and outputting a receiver signal; and a computer coupled to the associated devices, the computer configured to receive the receiver sig-

nals and determine the presence of hospital personnel in the patient locations, the computer further configured to alter device states based on the presence of hospital personnel.

Also according to the invention, a method of controlling devices in a patient location is provided. The method comprises the steps of associating the patient location to a patient; associating devices to the patient location; determining the presence of hospital personnel in the patient location; and altering the state of the devices based the presence of hospital personnel.

Also according to the invention, a hospital monitoring system for monitoring hospital personnel, a plurality of patient locations for patients, and associated devices is provided. The system comprises a locating and tracking system configured to locate and track hospital personnel located in the plurality of patient locations; a computer coupled to the associated devices and the locating and tracking system, the computer configured to determine the presence of hospital personnel in the patient locations from the locating and tracking system, the computer further configured to alter device states based on the presence of hospital personnel. The computer also includes a database, the database comprising a patient database, the patient database associated each patient with a patient location; a hospital personnel database, the hospital personnel database associating each hospital personnel with a caregiver or non-caregiver class, the hospital personnel database further associating hospital personnel with a patient; and an alarm database, the alarm database associating a plurality of alarms with the hospital personnel.

Additional features of the invention will become apparent to those skilled in the art upon consideration of the following detailed description of illustrated embodiments exemplifying the best mode of carrying out the invention as presently perceived.

BRIEF DESCRIPTION OF THE DRAWINGS

The detailed description particularly refers to the accompanying figures in which:

FIG. **1** is a block diagram illustrating the components of the hospital monitoring and control system of the present invention;

FIG. **2** is a perspective view of a portion of a hospital room which illustrates a patient station in a patient room and the physical arrangement of other components, including an incontinence detection device;

FIG. **3** depicts a database structure used to associate patients with hospital personnel, and associate hospital personnel with alarms;

FIG. **4** depicts the database association for a specific patient record, the patient associated with hospital personnel, and the hospital personnel associated with alarms;

FIG. **5** is a flowchart of an illustrative embodiment of an automatic alarm silencing process that includes association of patients, hospital personnel and alarms;

FIG. **6** is a flowchart of another illustrative embodiment of an automatic alarm silencing process that includes association of patients and hospital personnel;

FIG. **7** is a flowchart of an illustrative embodiment of an alarm silencing process in conjunction with a patient control lockout that includes a lockout of patient activated controls;

FIG. **8** is a flowchart of another illustrative embodiment of an automatic alarm silencing process in conjunction with a patient control lockout that includes a lockout of patient activated controls upon the occurrence of the alarm;

FIG. **9** is a flow chart of another illustrative embodiment describing a process that locks out patient bed controls and environmental controls based on the alarm priority;

FIG. **10** is a flow chart of another illustrative embodiment describing a process that prepares the patient environment for the caregiver based on the alarm priority;

FIG. **11** is a flow chart of another illustrative embodiment describing a process that prepares the patient environment for the caregiver based on the alarm priority, with each environmental preparation subject to an override condition;

FIG. **12** depicts the database association of the alarm database, the database containing Type, Priority, Lockouts and Overrides fields;

FIG. **13** is a block diagram illustrating the control circuitry for several environmental controls;

FIG. **14** is a block diagram illustrating the bed controller and associated bed controls;

FIG. **15** is a flow chart of another illustrative embodiment describing a process which lockouts and/or alters selected patient and environmental controls when a caregiver is present in the room; and

FIG. **16** is a flow chart of another illustrative embodiment describing a process which enables selected patient and environmental controls when a caregiver is present the room.

DETAILED DESCRIPTION OF THE DRAWINGS

Referring now to the drawings, FIGS. **1** and **2** illustrates a block diagram of the hospital monitoring and control system **10** of the present invention, and an illustrative hospital environment in which the system is utilized.

FIG. **2** illustrates a patient room **130** which includes a patient station **22** and the physical arrangement of other components, including an incontinence detection device **65**. The patient station **22** is illustratively a component of a nurse call system **40**. Caregiver **110** wears a badge **24** which clips to the caregiver's **110** clothing. The badge **24** transmits a pulse-coded signal, preferably infrared or RF, which is received by receiver **25**, which is preferably located at the patient station **22**, and/or an overhead receiver **125** so that the location and tracking systems **20** can determine and continuously update locations of caregivers **110** on duty. Overhead light **122** provides room illumination, and reading light **123** provides reading illumination for the patient. Overhead light **122** and reading light **123** are controlled by light controls **132** and **133**, respectively.

Pillow unit **28** connects via a cable **26** to a receptacle **27** which, in turn, is connected to the nurse call system **40**. Pillow unit **28** allows the patient **100** to manually place a nurse call or alarm via nurse call system **40**. Pillow unit also allows patient **100** access to bed **90** controls and environmental controls **50**. Bed **90** controls are also accessible by the caregiver **110** via control panel **140**.

Incontinence detection device **65** is interposed between the bed **90** and patient **100**. Incontinence detection device **65** is connected to the computer **12** via bed **90** electronics and cable **91** via receptacle **27**.

The system **10** illustratively includes a computer **12** configured to monitor various system alarms, device status, the hospital personnel information, and patient information. Computer **12** is coupled to a location and tracking system **20**. Location and tracking system **20** monitors and tracks the location of hospital personnel, patients and equipment within the hospital. Computer **12** is also connected to nurse call system **40**. Nurse call system **40** is associated with various alarms **42**. The alarms **42** illustratively include the following:

7,197,357	B2	3/2007	Istvan et al.	
7,197,492	B2	3/2007	Sullivan	
7,215,991	B2	5/2007	Besson et al.	
7,222,054	B2	5/2007	Geva	
7,231,258	B2	6/2007	Moore et al.	
7,242,308	B2	7/2007	Ulrich et al.	
7,256,708	B2	8/2007	Rosenfeld et al.	
7,272,428	B2	9/2007	Hopman et al.	
7,277,758	B2	10/2007	DiLorenzo	
7,283,423	B2	10/2007	Holm et al.	
7,292,135	B2	11/2007	Bixler et al.	
7,292,139	B2	11/2007	Mazar et al.	
7,294,105	B1	11/2007	Islam	
7,301,451	B2	11/2007	Hastings	
7,304,580	B2	12/2007	Sullivan et al.	
7,319,386	B2	1/2008	Collins, Jr. et al.	
7,324,824	B2	1/2008	Smith et al.	
7,336,563	B2	2/2008	Holm	
7,352,652	B2	4/2008	Holm et al.	
7,362,656	B2	4/2008	Holm	
7,384,110	B2	6/2008	Hoshiyama et al.	
7,443,302	B2	10/2008	Reeder et al.	
7,454,885	B2	11/2008	Lin et al.	
7,480,951	B2	1/2009	Weismiller et al.	
7,920,061	B2 *	4/2011	Klein et al.	340/541
8,026,821	B2	9/2011	Reeder et al.	
8,258,965	B2	9/2012	Reeder et al.	
2001/0034475	A1	10/2001	Flach et al.	
2002/0103674	A1	8/2002	Reeder et al.	
2002/0165731	A1	11/2002	Dempsey	
2002/0198986	A1	12/2002	Dempsey	
2003/0141981	A1	7/2003	Bui et al.	
2004/0072475	A1	4/2004	Istvan	
2004/0073127	A1	4/2004	Istvan et al.	
2004/0121767	A1	6/2004	Simpson et al.	
2004/0127802	A1	7/2004	Istvan et al.	
2004/0147818	A1	7/2004	Levy et al.	
2004/0167465	A1	8/2004	Mihai et al.	
2004/0176667	A1	9/2004	Mihai et al.	
2005/0140508	A1	6/2005	Tessier et al.	
2005/0148303	A1	7/2005	Dempsey	
2005/0168341	A1	8/2005	Reeder et al.	
2005/0177052	A1	8/2005	Istvan et al.	
2005/0197545	A1	9/2005	Hoggle	
2005/0206518	A1	9/2005	Welch et al.	
2005/0251002	A1	11/2005	Istvan et al.	
2005/0251003	A1	11/2005	Istvan et al.	
2005/0251004	A1	11/2005	Istvan et al.	
2006/0030759	A1	2/2006	Weiner et al.	
2006/0077759	A1	4/2006	Holm	
2006/0089539	A1	4/2006	Miodownik et al.	
2006/0106649	A1	5/2006	Eggers et al.	
2006/0122867	A1	6/2006	Eggers et al.	
2006/0136271	A1	6/2006	Eggers et al.	
2006/0143051	A1	6/2006	Eggers et al.	
2006/0190302	A1	8/2006	Eggers et al.	
2006/0214786	A1	9/2006	Bixler et al.	
2006/0220839	A1	10/2006	Fifolt et al.	
2006/0238350	A1	10/2006	Tessier	
2006/0239195	A1	10/2006	Camins et al.	
2006/0242293	A1	10/2006	Russ	
2006/0248221	A1	11/2006	Hottel et al.	
2006/0253281	A1	11/2006	Letzt et al.	
2006/0258926	A1	11/2006	Ali et al.	
2006/0267740	A1	11/2006	Bixler et al.	
2006/0277202	A1	12/2006	Dempsey	
2006/0279427	A1	12/2006	Becker et al.	
2006/0288095	A1	12/2006	Torok et al.	
2007/0013511	A1	1/2007	Weiner et al.	
2007/0060976	A1	3/2007	Denzene et al.	
2007/0069887	A1	3/2007	Welch et al.	
2007/0112602	A1	5/2007	Bellon et al.	
2007/0123955	A1	5/2007	Verhoef et al.	
2007/0135866	A1	6/2007	Baker et al.	
2007/0142716	A1	6/2007	Biondi	
2007/0156456	A1	7/2007	McGillin et al.	
2007/0156707	A1	7/2007	Fuchs et al.	
2007/0180140	A1	8/2007	Welch et al.	
2007/0208235	A1	9/2007	Besson et al.	
2007/0229249	A1	10/2007	McNeal et al.	
2007/0233199	A1	10/2007	Moore et al.	
2007/0251835	A1	11/2007	Mehta et al.	
2007/0255111	A1	11/2007	Baldus et al.	
2007/0255250	A1	11/2007	Moberg et al.	
2007/0255348	A1	11/2007	Holtzclaw	
2007/0258395	A1	11/2007	Jollota et al.	
2007/0279211	A1	12/2007	Fenske et al.	
2008/0009694	A1	1/2008	Hopman et al.	
2008/0018435	A1	1/2008	Brown	
2008/0049555	A1	2/2008	Holm et al.	
2008/0114689	A1	5/2008	Psynik et al.	
2008/0120784	A1	5/2008	Warner et al.	
2008/0122616	A1	5/2008	Warner et al.	
2008/0126122	A1	5/2008	Warner et al.	
2008/0126132	A1	5/2008	Warner et al.	
2008/0147442	A1	6/2008	Warner et al.	
2009/0096615	A1	4/2009	Reeder et al.	

OTHER PUBLICATIONS

Priyantha, et al., "The Cricket Location-Support System," ACM MOBICOM, Aug. 2000.

Chakraborty, Anit, "A Distributed Architecture for Mobile, Location-Dependent Applications," Massachusetts Institute of Technology (1999).

* cited by examiner

ALARM	PRIORITY	GENERATED BY
Code Blue	1	Human/Input Device
Staff Emergency	2	Human/Input Device
Bathroom	3	Human/Input Device
Shower	4	Human/Input Device
Patient Equipment	5	Automatic/Input Device

Illustratively, the alarms **42** will place a call to a caregiver through location and tracking system **20** and nurse call system **40**.

Computer **12** is also connected to hospital bed **90**. Hospital bed **90** is associated with alarms **92**. Alarms **92** include bed malfunction alarms and/or bed exit alarms, and incontinence detection device **65** alarms. Illustratively, alarms **92** will place a call to a caregiver through location and tracking system **20** and nurse call system **40**.

Bed **90** includes frame and resting surface devices **190** adjust the position of bed **90** and the position and shape of the resting surface, as illustrated in FIG. **14**. In addition, other devices are included in frame and resting surface devices **190**, such as resting surface vibration, temperature and firmness controls. Caregiver **110** accesses and changes the state of frame and resting surface devices **190** via control panel **140**, shown in FIG. **2**. FIG. **14** shows several frame and resting surface devices **190**, however FIG. **14** should not be considered an exhaustive list. Examples of frame and resting surface devices **190** include head position control **275**, back position control **280**, seat/thigh position control **285**, heating control **290**, firming bladder **295**, retracting footboard control **300**, turn assist bladder control **305** and vibration control **310**.

Head position control **275**, back position control **280** and seat/thigh position control **285** all alter the shape of the resting surface of bed **90**. Head position control **275** raises or lowers the head position of the resting surface generally coincident with the head of the patient. Back position control **280** raises or lowers the middle portion of the resting surface generally coincident with the back of the patient. Seat/thigh position control **285** raises or lowers the lower portion of the resting surface generally coincident with the seat and thighs of a patient.

Heating control **290** controls the temperature of the resting surface of bed **90**. Similarly, vibration control **310** controls the vibratory action of the resting surface of bed **90**. Firming bladder control **295** controls the firmness of the resting surface of bed **90**. Retracting footboard control **300** adjusts the length of the foot portion of the resting surface of bed **90**. This allows bed **90** to accommodate patients of various heights comfortably. Turn assist bladder control **305** controls rotation of the patient to reduce the likelihood of pulmonary complications. An interface pressure sensor and controller for a patient support surface such as an air mattress may also be coupled to the controller **190**.

Computer **12** is also connected to coupler **60**. The computer **12** may be coupled to monitors **62**, treatment devices **72**, and therapy devices **82** through coupler **60**. Illustratively, coupler **60** may be an RS-232 compatible cable or other suitable connector, such as a RS-485 compatible cable, Ethernet, or other network connection device known to those of ordinary skill in the art. Computer **12** processes signals from the monitors **62**, treatment devices **72**, and therapy devices **82** on a real time basis. The monitors **62**, treatment devices **72**, and therapy devices **82** include, but are not limited to, heart rate monitors, temperature sensors, blood pressure monitors (invasive and noninvasive), EKG monitors, blood oxygen sensors, capnographs, ventilators, IV pumps, scales, chest drainage monitors, and the like. Monitors **62**, treatment devices **72** and therapy devices **82** have associated alarms **64**, **74** and **84**, respectively. Illustratively, alarms **64**, **74**, and **84** will place a call to a caregiver through location and tracking system **20** and nurse call system **40**.

Computer **12** is also connected to environmental devices **50**. Alarm **52** is associated with environmental devices **50**. Environmental devices **50** illustratively include temperature control devices, such as a thermostat, and humidity control devices, such as a humidifier. Additionally, environmental devices **50** illustratively include entertainment devices such as a television/radio **120**, and lighting such as overhead light **122** and reading light **123**, all of which do not have alarms associated therewith.

Environmental devices **50** control environmental parameters within the patient room. FIG. **13** shows several different environmental devices **50**; however FIG. **13** should not be considered an exhaustive list. Examples of environmental devices **50** include TV/radio **120** control **345**, room temperature control **350** and lighting control **355**, which control overhead light **122** and reading light **123**.

TV/radio **120** control **345** controls the functions of the TV/radio **120** in the room. Room temperature control **350** is a thermostat control for altering the temperature of the patient's room. Lighting control **355** controls overhead light **122** and reading light **123**, and their brightness level.

In one embodiment, the status of the environmental controls is automatically altered when caregiver **110** enters the room. For example, the sound on TV/radio **120** is muted and overhead light **122** and/or reading light **123** controlled by lighting control **355** are activated. When caregiver **110** enters the room, receiver **25** receives the caregiver identification signal broadcast by caregiver badge **24**. After the computer **12** authenticates the identification signal, the computer **12** instructs TV/radio **120** control **345** to mute all sound and lighting device **355** to illuminate overhead light **122** and reading light **123**.

In another embodiment of the present invention, the computer **12** overrides one or more of the environmental controls within the room once the computer **12** authenticates the identification signal from the badge **24**. In other words, the patient can no longer control the environmental functions such as, for example, the radio, television or lighting when an authorized caregiver **110** is in the room.

Bed **90** includes lockout controls which prevent the patient **100** on bed **90** from actuating certain controls. These lockouts are typically actuated by pressing a button or a combination of two or more buttons on the bed to lock out various bed controls, environmental controls, or other functions. In one embodiment of the present invention, these bed lockouts cannot be changed without an authorized caregiver **110** within the room. In other words, when caregiver **110** enters the room, the receiver **25** receives the caregiver identification signal from the badge **24**. After the control unit authenticates the identification signal **24**, computer **12** then permits the bed lockout status to be changed.

Certain beds such as the TotalCare® bed available from Hill-Rom, Inc. are capable of moving from a generally flat bed position to a chair position. In one embodiment of the present invention, the bed is unable to move to a chair position unless an authorized caregiver **110** is located within the room. Again, the computer **12** must receive and authenticate the identification signal from badge **24** before the bed is permitted to move to the chair position. Thus, a feature is selectively locked out in the absence of a caregiver **110**.

FIG. **15** depicts shows a flow chart **1500** of the illustrative embodiments, and describes a process which lockouts and/or

alters selected patient and environmental controls when a caregiver **110** is present in the room. In step **1502**, the locating and tracking system **20** monitors the room for a caregiver **110**. If a caregiver enters the room, step **1504** exits the monitoring loop and enables step **1506**, which locks out and/or alters selected patient and environmental controls. In step **1508**, the locating and tracking system **20** monitors the room for the presence of the caregiver **110** and retains the state of **1506** as long as the caregiver **110** is in the room. When the caregiver **110** exits the room, the patient lockouts are removed and the environment is restored, along with the patient **100** controls to alter the environment.

FIG. **16** depicts shows a flow chart **1600** of another one of the illustrative embodiments, and describes a process which enables and/or alters selected patient and environmental controls when a caregiver **110** enters the room. In step **1602**, the locating and tracking system **20** monitors the room for a caregiver **110**. If a caregiver enters the room, step **1604** exits the monitoring loop and enables step **1606**, which enables and/or alters selected patient and environmental controls. In step **1608**, the locating and tracking system **20** monitors the room for the presence of the caregiver **110** and retains the state of **1606** as long as the caregiver **110** is in the room. When the caregiver **110** exits the room, the patient and environmental lockouts are restored.

FIG. **3** depicts a database structure used to associate patients with hospital personnel, and associate hospital personnel with alarms. Patient information is stored in patient database **200**. As depicted in FIG. **3**, there are numerous patients in the database, ranging from record number **1** to k.

Hospital personnel information is stored in hospital personnel database **300**. There are numerous hospital personnel in the hospital personnel database **300**, ranging from record number **1** to m. Furthermore, hospital personnel information stored in hospital personnel database **300** is categorized by personnel position. Illustratively, the hospital personnel database contains a "doctor" class, a "nurse" class, an "orderly" class, and a "non-caregiver" class. Non-caregiver class illustratively includes security staff, administrative staff, or janitorial staff.

Alarm database **400** stores alarm information for alarm records **1** to n, each record associated with a different alarm. Furthermore, alarm information stored in alarm database **300** includes alarm type and alarm priority. Thus, alarm record **1**, for example, may be associated with a cardiac arrest and allocated priority **1**, the highest priority and thus requiring immediate attention, and alarm record n may be associated with an incontinence event, and be allocated a lower priority.

FIG. **4** depicts the database association for a specific patient record, the patient associated with hospital personnel, and the hospital personnel associated with alarms. Illustratively, patient record **221** is associated with hospital personnel records **11**, **131**, and **211**. In the present example, the patient represented by patient record **221** has been admitted for a heart procedure requiring surgery. Hospital personnel records **11**, **131**, and **211** correspond to a surgeon, a cardiologist and a nurse, respectively. Alarms records **1-11** in alarm database **400** are associated with hospital personnel records **11**, **131**, and **211**. In the illustrative example, alarm records **1-3** are associated with hospital personnel record **11**, alarm records **3-7** are associated with hospital personnel record **131**, and alarm records **8-11** are associated with hospital personnel record **211**. Illustratively, alarm record **1** corresponds to a cardiac arrest, and has the highest priority, which requires the attention of a cardiologist. Alarm record **3** corresponds to a less severe cardiac event, such as an irregular heart rate, and thus has a lesser priority, and requires either the cardiologist or surgeon.

The flow diagram **500** of FIG. **5** depicts one illustrative embodiment of the automatic alarm silencing process that includes association of patients, hospital personnel and alarms. In step **502**, the computer **12** receives an alarm from either the location and tracking system **20**, the nurse call system **40**, a treatment device **72**, a therapy device **82**, environmental devices **50**, or the hospital bed **90**. Upon receiving the alarm signal, computer **12** gets the alarm priority from alarm database **400**, and may also notify the caregiver at their current location. In step **504**, the computer monitors the room **130** from which the alarm was received for a caregiver. In the illustrative embodiment disclosed herein, patient station **22** monitors the room **130** via receiver **25**. Upon entering the room **130**, a caregiver is identified by badge **24**, which emits an infrared pulse and is detected by receiver **25**. Computer **12** receives the caregiver identification and thus identifies the associated hospital personnel record in hospital personnel database **300**.

In step **506**, computer **12** determines whether the caregiver in room **130** is associated with the alarm priority stored in alarm database **400**. For example, if the alarm priority is 3, indicating a cardiac event of lower priority than a cardiac arrest, and the person entering the room is identified as a non-caregiver, e.g., a security officer, the alarm will not be silenced. Similarly, if the caregiver is identified as a nurse, the alarm will not be silenced. Conversely, if the caregiver is identified as a cardiologist or surgeon, which in this example is associated with the alarm of priority **3**, then step **508** determines if the doctor identified is associated with that patient. If the doctor is associated with the patient, then the alarm is silenced in step **510**. If the doctor is not associated with the patient, the alarm is not silenced.

The flow diagram **600** of FIG. **6** depicts another illustrative embodiment of the automatic alarm silencing process that includes associating patients with hospital personnel. In step **602**, the computer **12** receives an alarm from either the location and tracking system **20**, the nurse call system **40**, a treatment device **72**, a therapy device **82**, environmental devices **50**, or the hospital bed **90**. Upon receiving the alarm signal, computer **12** monitors the room **130** from which the alarm was received for a caregiver, as shown in step **604**. In the illustrative embodiment disclosed herein, patient station **22** monitors the room **130** via receiver **25**. Upon entering the room **130**, a caregiver is identified by badge **24**, which emits an infrared and/or RF pulse and is detected by receiver **25**. Computer **12** receives the caregiver identification and thus identifies the associated hospital personnel record in hospital personnel database **300**. Step **606** determines if the caregiver is associated with the patient. If the caregiver is associated with the patient, then the alarm is silenced in step **608**. If the caregiver is not associated with the patient, the alarm is not silenced.

The flow diagram **700** of FIG. **7** depicts another illustrative embodiment of the automatic alarm silencing process that includes a lockout of patient activated controls. In step **702**, the computer **12** receives an alarm from either the location and tracking system **20**, the nurse call system **40**, a treatment device **72**, a therapy device **82**, environmental devices **50**, or the hospital bed **90**. Upon receiving the alarm signal, computer **12** monitors the room **130** from which the alarm was received for a caregiver, as shown in step **704**. In the illustrative embodiment disclosed herein, patient station **22** monitors the room **130** via receiver **25**. Upon entering the room **130**, a caregiver is identified by badge **24**, which emits an infrared

pulse and is detected by receiver **25**. Once the caregiver enters the room, step **706** silences the alarm and locks out any patient activated controls, such as bed **90** controls or television/radio **120** controls, thus decreasing the likelihood that the patient **100** may inadvertently interfere with caregiver **110** while the caregiver **110** administers the required therapy in response to the alarm.

The flow diagram **800** of FIG. **8** depicts another illustrative embodiment of the automatic alarm silencing process in conjunction with a patient control lockout that includes a lockout of patient activated controls immediately upon the occurrence of an alarm. Locking out patient and environmental controls as soon as an alarm is received is desirable should the patient **100** be suffering from severe condition, such as a cardiac arrest or seizure, so as to prevent a patient s involuntary movement from accidentally activating a bed **90** or environmental devices **50**.

In step **802**, the computer **12** receives an alarm from either the location and tracking system **20**, the nurse call system **40**, a treatment device **72**, a therapy device **82**, environmental devices **50**, or the hospital bed **90**. Upon receiving the alarm signal, computer **12** immediately locks out all patient and environmental controls as shown in step **804**. Controller **12** then monitors the room **130** from which the alarm was received for a caregiver, as shown in step **806**. Once the caregiver enters the room, step **808** silences the alarm.

Often an alarm may sound when a caregiver **110** in present in the hospital room **130**. In such a situation, it is not desirable to automatically cancel the alarm, as the caregiver **110** may not immediately notice the alarm, or the alarm may be suppressed before it emits an audible signal. Accordingly, alternative embodiments to FIGS. **5-8** include a step that determines whether a caregiver **110** is present in the room **130** when the alarm sounds; if a caregiver **110** is present, the alarm is not automatically suppressed by the presence of the caregiver **110**. Computer **12** is configured to allow the alarm to sound for a predetermined amount of time so that the caregiver **110** can assess which alarm is sounding. Alternatively, computer **12** is configured to require the caregiver **110** to manually shut off the alarm. Conversely, if a caregiver **110** is not in the room **130**, then the processes are the same as depicted in FIGS. **5-8**.

Depending on the alarm priority, locking out patient controls may not be desirable. For example, if patient **100** experiences an incontinence event, the patient may desire to exit the bed to personally tend to his hygiene needs. However, locking out the bed controls can impede patient **100** from exiting the bed. Conversely, if the patient is experiencing a seizure, locking out the bed **90** controls and environmental devices **50** is desirable so to prevent a patient's involuntary movement from accidentally activating a bed **90** or environmental devices **50**.

FIG. **9** shows a flow chart **900** of another illustrative embodiment describing a process that locks out patient bed controls and environmental controls based on the alarm priority. In step **902**, computer **12** receives an alarm. In step **904**, the alarm priority is assessed. Step **906** determines whether a patient lock out is required. A higher priority alarm, such as a code blue or cardiac arrest alarm, will warrant locking out most, if not all, controls accessible by patient **90**. Conversely, a lower priority alarm, such as an incontinence event, will warrant few, if any, control lock outs. Thus, step **908** determines whether a full lockout or a partial lockout is required. If a full lockout is required, step **910** selects all patient controls for lockout. Conversely, if only a partial lockout is required, step **912** selects which patient controls are to be locked out. The lockouts can either be preset in the system or manually set by hospital personnel. All selected controls are then locked out in step **914**.

Similarly, depending on the priority of the alarm, the patient **100** environment may be prepared for the arrival of the caregiver **110**. For example, if patient **100** experiences a cardiac arrest while watching television/radio **120**, television/radio **120** will be immediately shut off. As a cardiac arrest usually warrants a response team, shutting off the television/radio **120** will ensure that this device will not distract any member of the response team. Conversely, if a patient **100** experiences only a slight incontinence event while watching television, which may not even be noticeable to the patient **100**, the better therapy may be to let the patient **100** rest and tend to the patient **100** at a later time. As such, the television/radio **120** will not be shut off automatically. Thus, the environmental devices **50** may not be altered, based on the event magnitude of an associated alarm.

FIG. **10** shows a flow chart **1000** of another illustrative embodiment describing that process that prepares the patient environment for the caregiver based on the alarm priority. In step **1002**, computer **12** receives an alarm. In step **1004**, the alarm priority is assessed. Step **1006** determines whether environmental preparation is required. A higher priority alarm, such as a code blue or cardiac arrest alarm, will warrant environmental preparation. Conversely, a lower priority alarm, such as a slight incontinence event, will not require an environmental preparation. If an environmental preparation is required, the environment is prepared in step **1008**.

FIG. **11** shows a flow chart **1100** of another illustrative embodiment describing a process that prepares the patient environment for the caregiver based on the alarm priority, with each environmental preparation subject to an override condition. Illustratively, an environmental preparation can be subject to an override condition depending on the time of day. For example, if patient **100** experiences a cardiac arrest in the evening while sleeping, it is likely that room **130** lighting is low or off. Given the seventy of a cardiac arrest, which warrants a response team, an environmental preparation includes turning on the room **130** lighting. As such, overhead light **122** will immediately illuminate the room, as a response team will most likely arrive soon after the alarm is generated. Conversely, if a patient **100** experiences only a slight incontinence event during the evening while sleeping, the better therapy may be to let the patient **100** rest and tend to the patient **100** in the morning. As such, no environmental preparations is required and overhead light **122** remains off.

Once the environmental preparations are determined, step **1102** selects the next environmental preparation from the list, beginning with the first. In step **1104**, the environmental preparation is checked for an override condition. Illustratively, overhead light **122**, which normally would illuminate once an incontinence event is detected, will not illuminate if the time is outside visiting hours, e.g., from 8:00 PM-8:00 AM. If no override condition exists, the environment is prepared accordingly in step **1106**; if an override condition for that particular environmental preparation exists, then the environment is not prepared with respect to that particular environmental preparation. If any environmental preparations remain, step **1108** repeats the process for the next environmental preparation. If no environmental preparations remain, then the process is complete.

The lockouts and overrides corresponding to an alarm can be configured through a common database structure. FIG. **12** depicts the database association of the alarm database **400**, the database containing type **410**, priority **420**, lockout **430** and override **440** fields. The type **410** field stores the alarm

type. Type **410** field contains records **1** . . . k, priority **420** field contains records **1** . . . **1**, lockout **430** field contains records **1** . . . m, and override **440** field contains record **1** . . . n.

Illustratively, alarm types correspond to the equipment and/or patient **100** condition. Thus, type **410** values include "Incontinence Event", "Cardiac Arrest", "Low Blood Pressure", "Smoke Alarm", etc.

The priority **420** fields stores the alarm priority and corresponds the alarm priority to the alarm type. Illustratively, a higher alarm priority corresponds to more immediate needs of the patient **100** or possibly a life threatening condition the patient **100** is experiencing. As shown in FIG. **12**, two records from the type **410** field have been assigned a priority **2**. Thus, if an alarm corresponding to either of those two records is received, it is assigned priority **2**.

The lockouts **430** field stores the patient lockouts, the environmental lockouts, and environmental preparations. Illustratively, the lockouts correspond to the alarm priority. As shown in FIG. **12**, a priority **2** alarm has been assigned three lockouts. Illustratively, the lockouts correspond to bed **90** siderails, overhead light **122**, and television/radio **120**. Thus, if a priority **2** alarm is received, the patient will not be able to operate the bed **90** siderails, overhead light **122**, and television/radio **120**.

The override **440** field stores overrides corresponding to the lockouts **430**. As shown in FIG. **12**, one lockout has two potential overrides. Illustratively, the lockout corresponds to the bed **90** siderail, and the override conditions are "Visiting Hours" or "Minor Incontinence Event." Thus, if a patient **90** experiences an incontinence event that is only a minor event, the bed **90** siderails will not be locked out. Additionally, if the incontinence event occurs during visiting hours, the bed **90** siderails will not be locked out.

One of ordinary skill in the art will readily appreciate that the database configuration of FIGS. **3**, **4** and **12** are illustrative only, and that other configurations or structures are readily apparent. For example, overrides can be correlated to priority, or priority and lockouts, etc. Furthermore, the illustrative fields are not exhaustive and other categorization schemes exist known to those of ordinary skill in the art.

Although the invention has been described in detail with reference to certain illustrated embodiments, variations exist within the scope and spirit of the invention as described and as defined in the following claims.

What is claimed is:

1. A computing device to monitor caregivers and equipment, the computing device comprising a processor and processor-executable instructions embodied in one or more machine-accessible media to:

receive an alarm signal from a vital signs monitor associated with a patient located in a patient room, the alarm signal indicating that an alarm is activated at the vital signs monitor;

determine whether a caregiver is located in the patient room; and

send a signal to the vital signs monitor to silence the alarm in response to the caregiver being detected in the patient room.

2. The computing device of claim **1**, wherein the computing device is configured to receive the alarm signal from a vital signs monitor comprising at least one of a heart rate monitor, a temperature sensor, a blood pressure monitor, an EKG monitor, a blood oxygen sensor, and a capnograph.

3. The computing device of claim **1**, wherein the computing device is configured to determine whether the caregiver is assigned to the patient, silence the alarm in response to the caregiver being assigned to the patient, and continue the alarm in response to the caregiver not being assigned to the patient.

4. The computing device of claim **1**, wherein the computing device is configured to determine a priority level associated with the alarm and determine whether the caregiver can respond to the alarm based on the priority level.

5. The computing device of claim **4**, wherein the computing device is configured to silence the alarm in response to determining that the caregiver can respond to the alarm.

6. The computing device of claim **1**, wherein the computing device is configured to receive wireless signals from a locating and tracking badge and determine whether the caregiver is located in the patient room based on the wireless signals.

7. The computing device of claim **1**, wherein the computing device is configured to send the signal to silence the alarm to the vital signs monitor a predetermined amount of time after determining that the caregiver is located in the patient room.

8. The computing device of claim **1**, configured to monitor the patient room to determine whether the caregiver continues to be located in the patient room after determining that the caregiver is located in the patient room.

9. The computing device of claim **1**, configured to send a lockout signal to a bed located in the patient room to prevent the patient from actuating one or more controls of the bed in response to receiving the alarm signal.

10. The computing device of claim **1**, configured to send a lockout signal to a bed located in the patient room to prevent the patient from actuating one or more controls of the bed in response to determining that the caregiver is located in the patient room.

11. The computing device of claim **10**, configured to determine a priority level associated with the alarm and configure the lockout signal according to the alarm priority level.

12. A method of monitoring caregivers and equipment, the method comprising, with a computing device:

receiving an alarm signal from a vital signs monitor associated with a patient located in a patient room, the alarm signal indicating that an alarm is activated at the vital signs monitor;

determining whether a caregiver is located in the patient room; and

sending a lockout signal to another device located in the patient room in response to the caregiver being detected in the patient room, the lockout signal being configured to prevent the patient from actuating one or more controls of the other device.

13. The method of claim **12**, comprising sending a signal to the vital signs monitor to silence the alarm in response to the caregiver being detected in the patient room.

14. The method of claim **12**, wherein the vital signs monitor comprises at least one of a heart rate monitor, a temperature sensor, a blood pressure monitor, an EKG monitor, a blood oxygen sensor, and a capnograph.

15. The method of claim **12**, wherein the other device located in the patient room comprises a bed.

16. The method of claim **12**, wherein the other device located in the patient room comprises at least one of a television, a radio, and a light.

17. The method of claim **12**, comprising sending a signal to the vital signs monitor to silence the alarm in response to the caregiver being detected in the patient room and the one or more controls of the other device being locked out from patient use.

18. At least one machine-accessible storage medium comprising instructions for executing the method of claim 12.

19. A computer configured to execute the method of claim 12.

20. A system comprising a transmitter, a receiver, and a computer arranged to execute the method of claim 12.

* * * * *

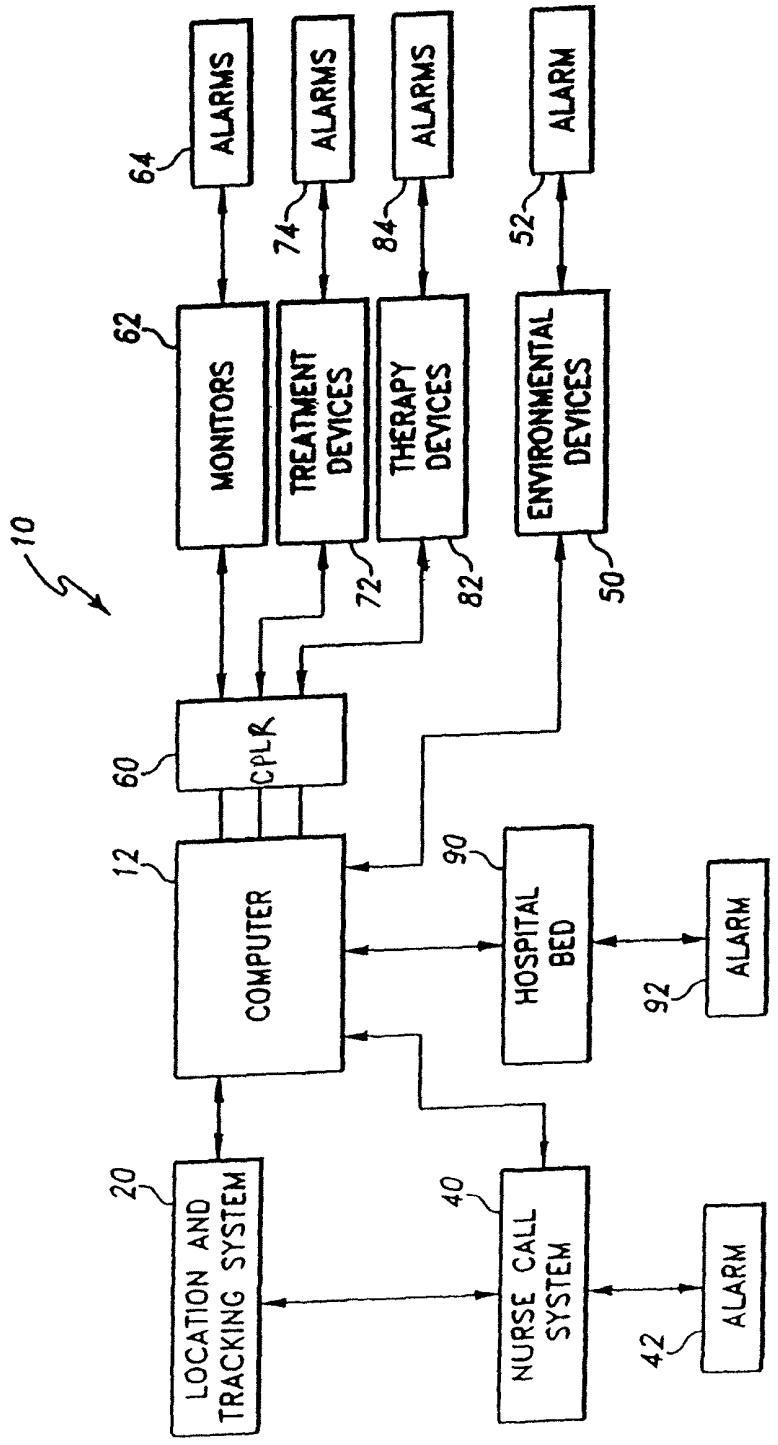

10
ALARMS
64
ALARMS
74
ALARMS
84
ALARM
52
MONITORS
62
TREATMENT DEVICES
THERAPY DEVICES
ENVIRONMENTAL DEVICES
72
82
50
CPLR
60
COMPUTER
12
90
HOSPITAL BED
ALARM
92
LOCATION AND TRACKING SYSTEM
20
40
NURSE CALL SYSTEM
ALARM
42

Fig. 1

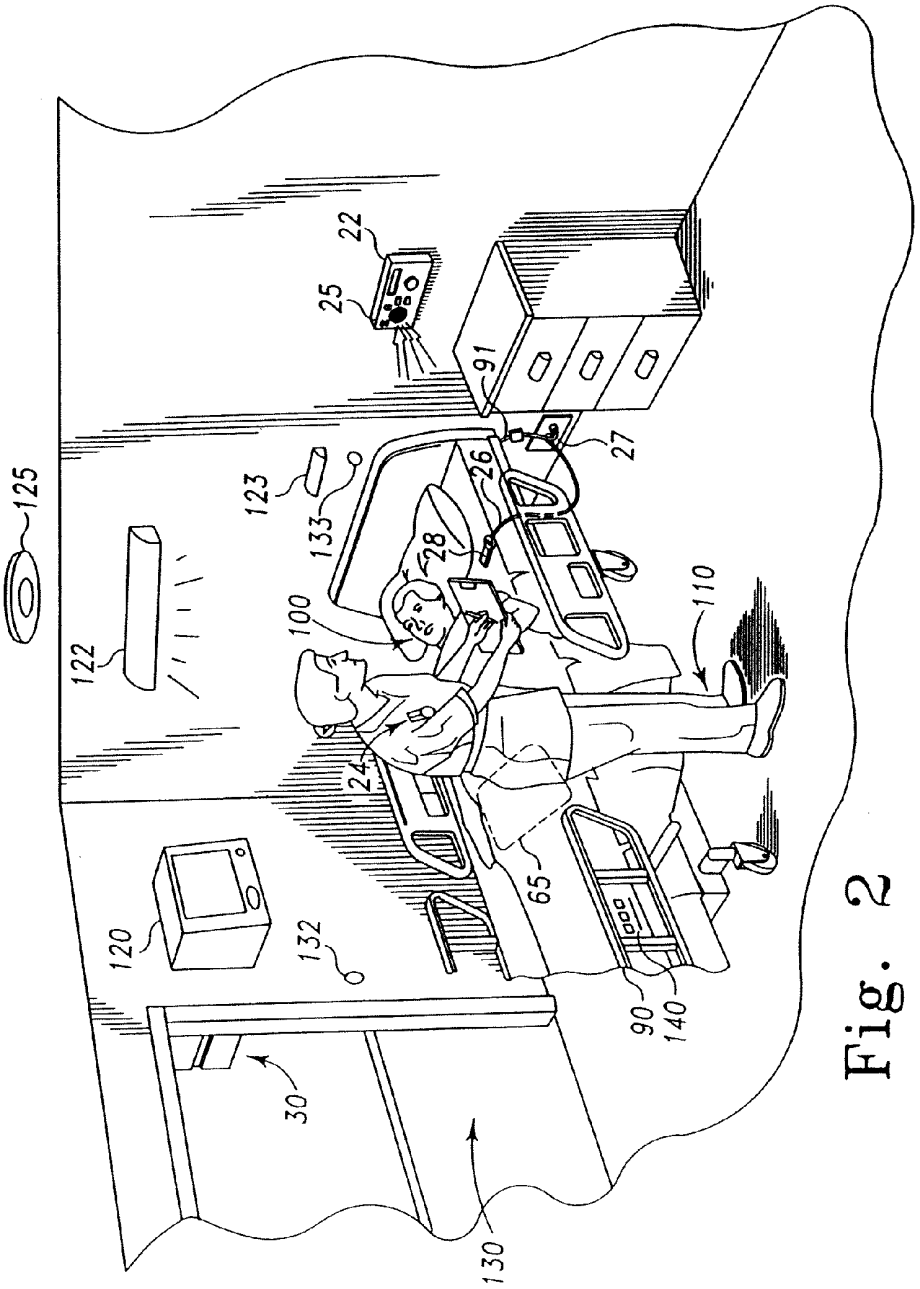

125
122
120
132
30
130
24
100
123
133
28
26
27
25
22
91
65
90
140
110

Fig. 2

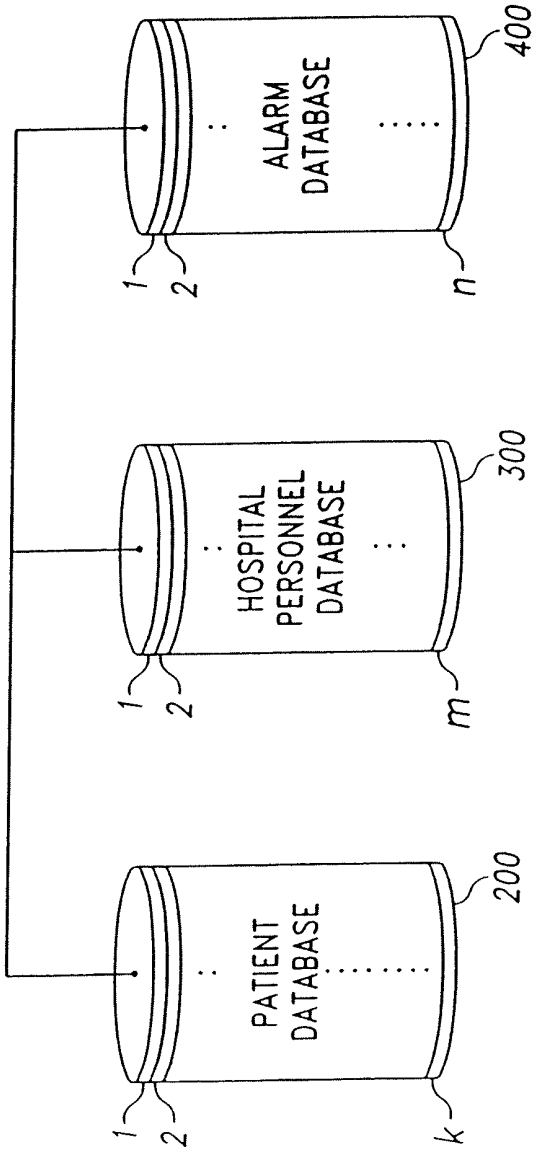

ALARM DATABASE
400
1
2
n
HOSPITAL PERSONNEL DATABASE
300
1
2
m
PATIENT DATABASE
200
1
2
k

Fig. 3

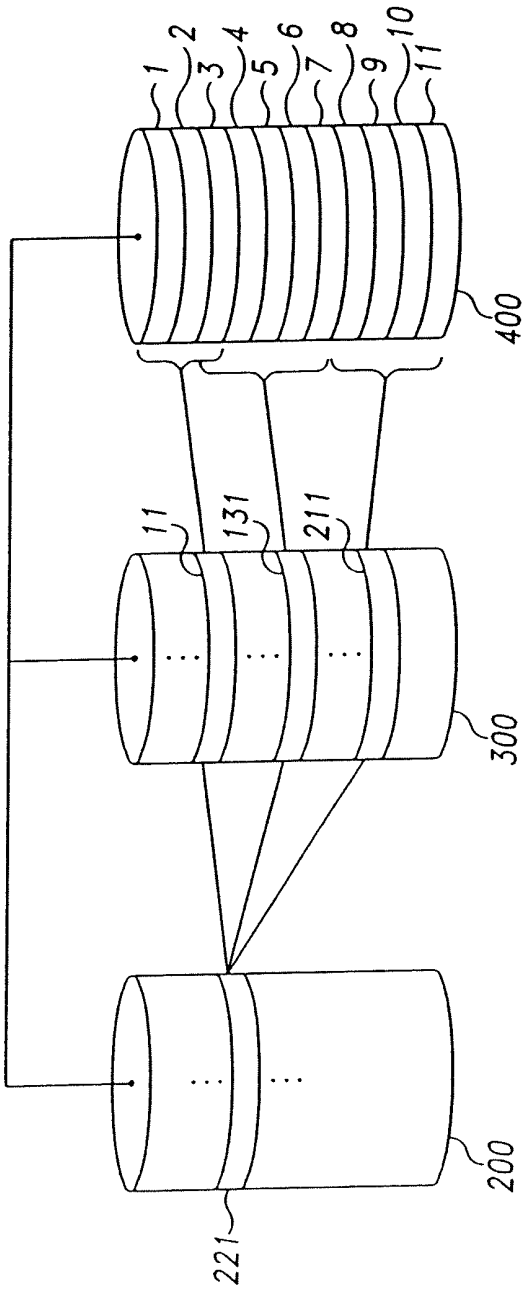


Fig. 4

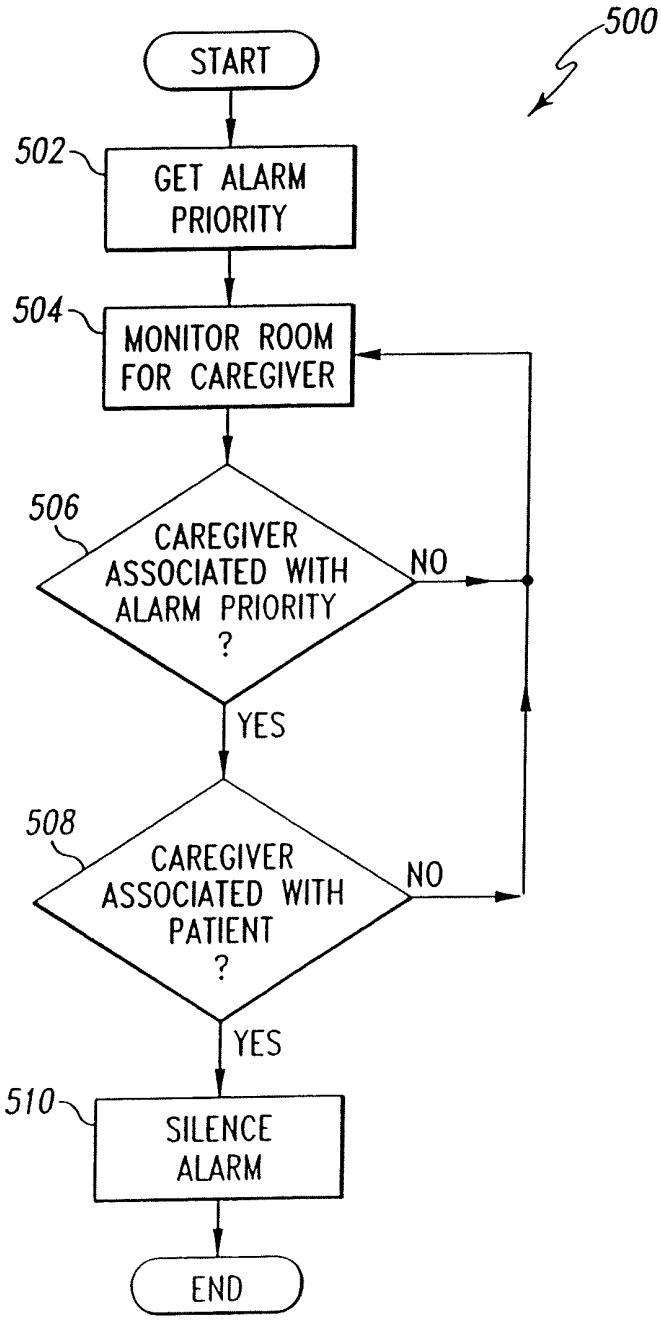

500
START
502
GET ALARM PRIORITY
504
MONITOR ROOM FOR CAREGIVER
506
CAREGIVER ASSOCIATED WITH ALARM PRIORITY ?
NO
YES
508
CAREGIVER ASSOCIATED WITH PATIENT ?
NO
YES
510
SILENCE ALARM
END

Fig. 5

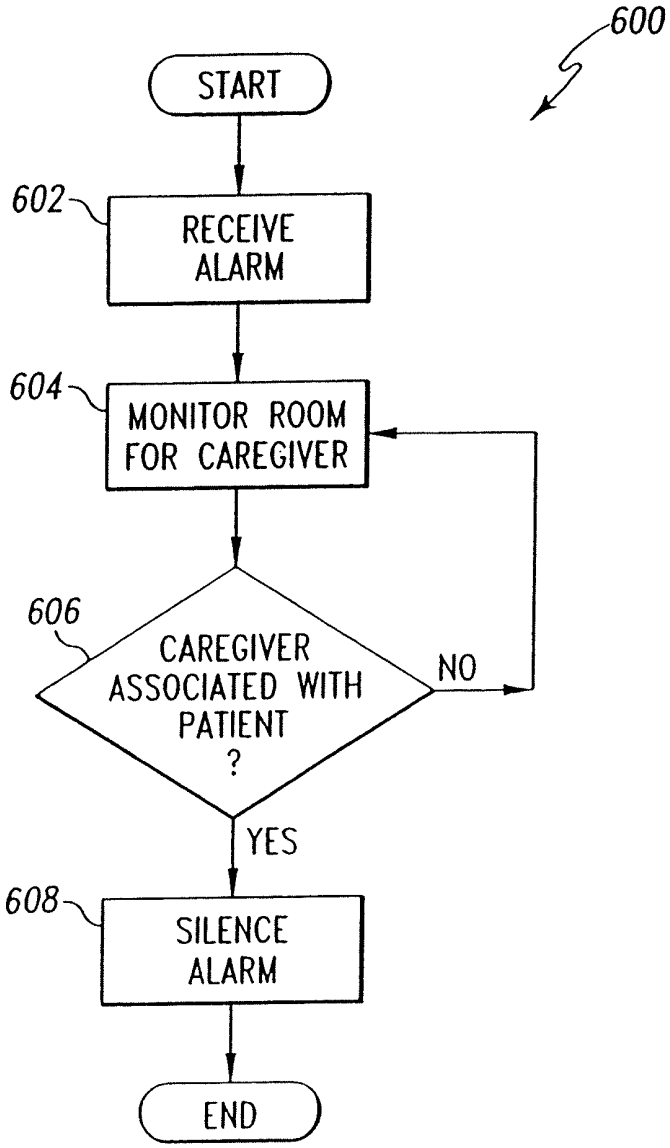

600
START
602
RECEIVE ALARM
604
MONITOR ROOM FOR CAREGIVER
606
CAREGIVER ASSOCIATED WITH PATIENT ?
NO
YES
608
SILENCE ALARM
END

Fig. 6

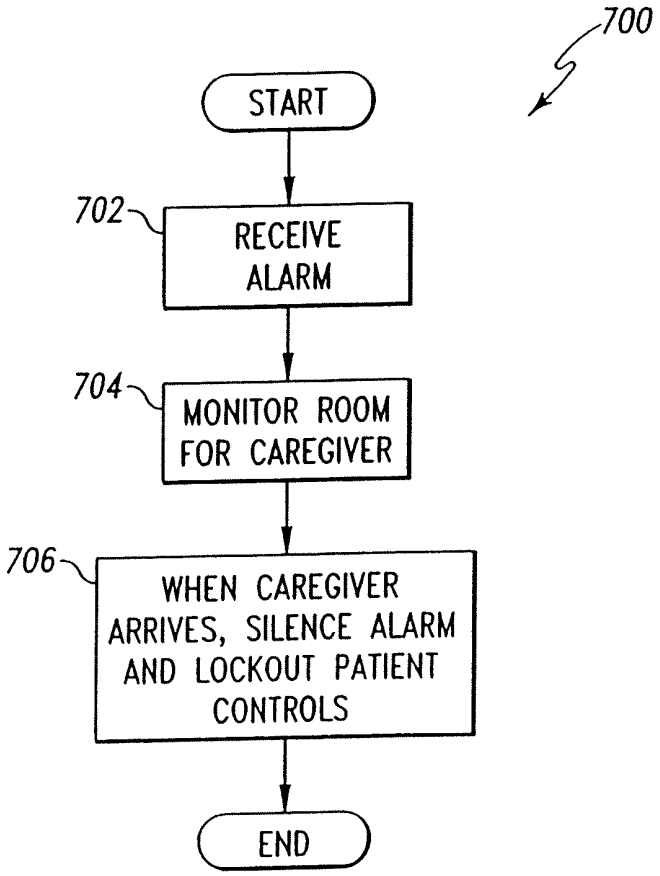
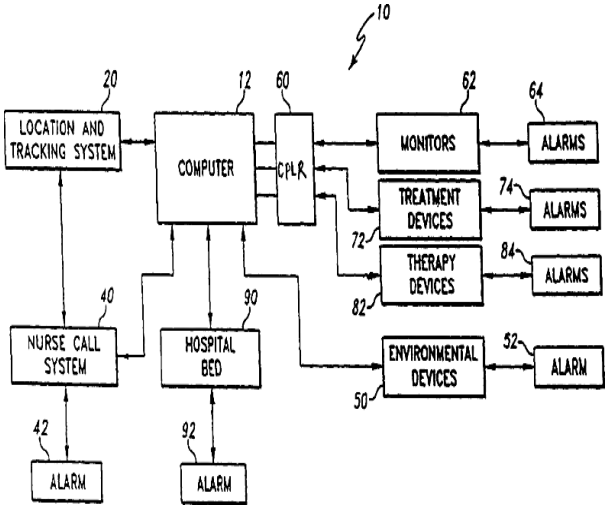

700
START
702
RECEIVE ALARM
704
MONITOR ROOM FOR CAREGIVER
706
WHEN CAREGIVER ARRIVES, SILENCE ALARM AND LOCKOUT PATIENT CONTROLS
END

Fig. 7

专利名称(译)	用于监控护理人员和设备的系统		
公开(公告)号	US8487774	公开(公告)日	2013-07-16
申请号	US13/599110	申请日	2012-08-30
[标]申请(专利权)人(译)	里德RYAN ANTHONY KRAMER KENNETH大号 JACQUES II WILLIAM大号 RILEY CARLW¯ SCHUMAN RICHARDĴ		
申请(专利权)人(译)	里德RYAN ANTHONY KRAMER KENNETH L. 雅克二威廉. RILEY CARL W. SCHUMAN理查德·		
当前申请(专利权)人(译)	HILL-ROM SERVICES，INC.		
[标]发明人	REEDER RYAN A KRAMER KENNETH L JACQUES WILLIAM L RILEY CARL W SCHUMAN RICHARD J		
发明人	REEDER, RYAN A. KRAMER, KENNETH L. JACQUES, WILLIAM L. RILEY, CARL W. SCHUMAN, RICHARD J.		
IPC分类号	G08B23/00 A61G7/05 A61B5/00 A61B5/0205 A61B5/11 A61G7/018 A61G12/00 G06F19/00 G06Q50/24 G08B5/22 G08B21/02 G08B25/00 G16H10/60		
CPC分类号	A61B5/0002 A61B5/1113 A61B5/742 A61B5/7475 A61G12/00 G06F19/322 G06F19/324 G06F19/327 G06F19/3406 G06F19/3418 G06Q50/24 G08B5/222 G08B25/008 A61G7/0506 A61B2560/0242 A61B2560/0443 A61B2560/0456 A61G7/018 A61G7/05 A61G2203/12 Y10S128/903 Y10S128/904 A61G2203/70 A61G2203/46 A61B5/02055 G16H10/60 G16H40/20 G16H40/40 G16H40/60 G16H40/63		
审查员(译)	NGUYEN，HUNG T.		
优先权	60/202283 2000-05-05 US 60/202284 2000-05-05 US 60/229136 2000-08-30 US		
其他公开文献	US20120319836A1		
外部链接	Espacenet USPTO		

摘要(译)

用于监控医院人员，用于患者的多个患者位置以及相关设备的医院监控系统被配置为基于医院人员或警报的存在来控制相关联的设备。


10
20
LOCATION AND TRACKING SYSTEM
12
COMPUTER
60
CPLR
62
MONITORS
64
ALARMS
TREATMENT DEVICES
74
ALARMS
72
THERAPY DEVICES
84
ALARMS
82
40
NURSE CALL SYSTEM
90
HOSPITAL BED
ENVIRONMENTAL DEVICES
52
ALARM
50
42
ALARM
92
ALARM