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(54) **WIRELESS BED CONNECTIVITY**

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(52) **U.S. Cl.** **340/539.12**; 340/506; 340/517; 340/521; 340/825.36; 340/825.49
(58) **Field of Classification Search** 340/506, 340/517, 521, 524, 525, 3.1, 825.36, 825.49
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

| | | | |
|-----------|---|---------|---------------------|
| 2,330,356 | A | 9/1943 | Belliveau |
| 2,335,524 | A | 11/1943 | Lomax |
| 2,736,888 | A | 2/1956 | McLain |
| 2,896,021 | A | 7/1959 | Phillips |
| 3,098,220 | A | 7/1963 | De Graaf |
| 3,439,320 | A | 4/1969 | Ward |
| 3,478,344 | A | 11/1969 | Schwitzgebel et al. |
| 3,553,383 | A | 1/1971 | Rochtus |
| 3,599,199 | A | 8/1971 | Bunting |
| 3,599,200 | A | 8/1971 | Bunting |
| 3,696,384 | A | 10/1972 | Lester |
| 3,739,329 | A | 6/1973 | Lester |

(Continued)

FOREIGN PATENT DOCUMENTS

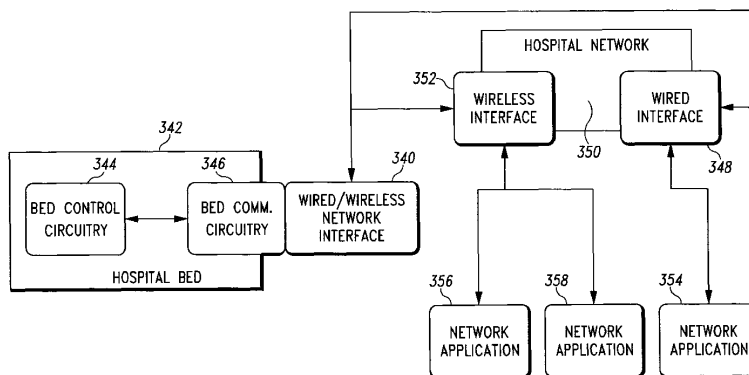
| | | | |
|----|----------------|----|---------|
| WO | WO 02/091297 | A1 | 11/2002 |
| WO | WO 2004/036390 | A2 | 4/2004 |

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(57) **ABSTRACT**

A hospital bed has wireless communication circuitry operable to transmit wirelessly bed status data. A surface supported by the bed has wireless communication circuitry operable to transmit wirelessly surface status data. The wireless communication circuitry of the hospital bed and the wireless communication circuitry of the surface communicate with a network independently. A hospital bed with an integrated surface has wireless communication circuitry operable to transmit wirelessly bed status data and surface status data. The wireless bed status data and the wireless surface status data are received by wireless access points of a network of a healthcare facility.

51 Claims, 16 Drawing Sheets



| U.S. PATENT DOCUMENTS | | | | | |
|-----------------------|---------|------------------------------|---------------|---------|------------------------|
| 3,767,859 A | 10/1973 | Doering et al. | 5,461,390 A | 10/1995 | Hoshen |
| 3,805,265 A | 4/1974 | Lester | 5,475,367 A | 12/1995 | Prevost |
| 3,913,153 A | 10/1975 | Adams et al. | 5,534,851 A | 7/1996 | Russek |
| 3,973,200 A | 8/1976 | Akerberg | 5,537,459 A | 7/1996 | Price et al. |
| 4,067,005 A | 1/1978 | Levy et al. | 5,548,637 A | 8/1996 | Heller et al. |
| 4,150,284 A | 4/1979 | Trenkler et al. | 5,549,113 A | 8/1996 | Halleck et al. |
| 4,151,407 A | 4/1979 | McBride et al. | 5,561,412 A | 10/1996 | Novak et al. |
| 4,183,015 A | 1/1980 | Drew et al. | 5,568,119 A | 10/1996 | Schipper et al. |
| 4,216,462 A | 8/1980 | McGrath et al. | 5,576,952 A | 11/1996 | Stutman et al. |
| 4,225,953 A | 9/1980 | Simon et al. | 5,579,001 A | 11/1996 | Dempsey et al. |
| 4,228,426 A | 10/1980 | Roberts | 5,588,005 A | 12/1996 | Ali et al. |
| 4,237,344 A | 12/1980 | Moore | 5,594,786 A | 1/1997 | Chaco et al. |
| 4,264,982 A | 4/1981 | Sakarya | 5,621,388 A | 4/1997 | Sherburne et al. |
| 4,275,385 A | 6/1981 | White | 5,635,907 A | 6/1997 | Bernard et al. |
| 4,279,433 A | 7/1981 | Petaja | 5,636,245 A | 6/1997 | Ernst et al. |
| 4,298,863 A | 11/1981 | Natitus et al. | 5,640,953 A | 6/1997 | Bishop et al. |
| 4,331,953 A | 5/1982 | Blevins et al. | 5,650,769 A | 7/1997 | Campana, Jr. |
| 4,356,475 A | 10/1982 | Neumann et al. | 5,650,770 A | 7/1997 | Schlager et al. |
| 4,418,334 A | 11/1983 | Burnett | 5,664,270 A | 9/1997 | Bell et al. |
| 4,455,548 A | 6/1984 | Burnett | 5,682,139 A | 10/1997 | Pradeep et al. |
| 4,489,387 A | 12/1984 | Lamb et al. | 5,686,888 A | 11/1997 | Welles, II |
| 4,495,495 A | 1/1985 | Ormanns et al. | 5,686,902 A | 11/1997 | Reis et al. |
| 4,495,496 A | 1/1985 | Miller, III | 5,687,734 A | 11/1997 | Dempsey et al. |
| 4,539,560 A | 9/1985 | Fleck et al. | 5,689,229 A | 11/1997 | Chaco et al. |
| 4,577,185 A | 3/1986 | Andersen | 5,691,980 A | 11/1997 | Welles, II et al. |
| 4,578,671 A | 3/1986 | Flowers | 5,699,038 A | 12/1997 | Ulrich et al. |
| 4,593,273 A | 6/1986 | Narcisse | 5,705,980 A | 1/1998 | Shapiro |
| 4,598,275 A | 7/1986 | Ross et al. | 5,708,421 A | 1/1998 | Boyd |
| 4,601,064 A | 7/1986 | Shiple | 5,713,856 A | 2/1998 | Eggers et al. |
| 4,649,385 A | 3/1987 | Aires et al. | 5,719,761 A | 2/1998 | Gatti et al. |
| 4,680,790 A | 7/1987 | Packard et al. | 5,731,757 A | 3/1998 | Layson, Jr. |
| 4,709,330 A | 11/1987 | Yokoi et al. | 5,742,237 A | 4/1998 | Bledsoe |
| 4,740,788 A | 4/1988 | Konneker | 5,751,246 A | 5/1998 | Hertel |
| 4,752,951 A | 6/1988 | Konneker | 5,752,917 A | 5/1998 | Fuchs |
| 4,792,798 A | 12/1988 | Wilowski | 5,760,704 A | 6/1998 | Barton et al. |
| 4,795,905 A | 1/1989 | Zierhut | 5,767,791 A | 6/1998 | Stoop et al. |
| 4,814,751 A | 3/1989 | Hawkins et al. | 5,781,442 A | 7/1998 | Engleson et al. |
| 4,833,452 A | 5/1989 | Currier | 5,793,290 A | 8/1998 | Eagleson et al. |
| 4,833,467 A | 5/1989 | Kobayashi et al. | 5,808,564 A | 9/1998 | Simms et al. |
| 4,837,568 A | 6/1989 | Snaper | 5,812,056 A | 9/1998 | Law |
| 4,853,692 A | 8/1989 | Wolk et al. | 5,822,418 A | 10/1998 | Yacenda et al. |
| 4,899,135 A | 2/1990 | Ghahariiran | 5,822,544 A | 10/1998 | Chaco et al. |
| 4,947,152 A | 8/1990 | Hodges | 5,838,223 A | 11/1998 | Gallant et al. |
| 4,955,000 A | 9/1990 | Nastrom | 5,844,488 A | 12/1998 | Musick |
| 4,967,195 A | 10/1990 | Shiple | 5,867,821 A | 2/1999 | Ballantyne et al. |
| 4,990,892 A | 2/1991 | Guest et al. | 5,877,675 A | 3/1999 | Rebstock et al. |
| 4,998,095 A | 3/1991 | Shields | 5,933,488 A | 8/1999 | Marcus et al. |
| 4,998,939 A | 3/1991 | Pothast et al. | 5,936,539 A | 8/1999 | Fuchs |
| 5,006,830 A | 4/1991 | Merritt | 5,942,986 A | 8/1999 | Shabot et al. |
| 5,027,314 A | 6/1991 | Linwood et al. | 5,944,659 A | 8/1999 | Flach et al. |
| 5,041,086 A | 8/1991 | Koenig et al. | 5,963,137 A | 10/1999 | Waters, Sr. |
| 5,062,151 A | 10/1991 | Shiple | 5,974,389 A | 10/1999 | Clark et al. |
| 5,065,154 A | 11/1991 | Kaiser | 5,991,728 A | 11/1999 | DeBusk et al. |
| 5,086,290 A | 2/1992 | Murray et al. | 5,995,937 A | 11/1999 | DeBusk et al. |
| 5,103,108 A | 4/1992 | Crimmins | 6,014,633 A | 1/2000 | DeBusk et al. |
| 5,124,991 A | 6/1992 | Allen | 6,057,758 A | 5/2000 | Dempsey et al. |
| 5,137,033 A | 8/1992 | Norton | 6,057,782 A | 5/2000 | Koenig |
| 5,153,584 A | 10/1992 | Engira | 6,067,019 A | 5/2000 | Scott |
| 5,266,944 A | 11/1993 | Carroll et al. | 6,076,166 A | 6/2000 | Moshfeghi et al. |
| 5,291,399 A | 3/1994 | Chaco | 6,078,261 A * | 6/2000 | Davsko 340/573.4 |
| 5,319,355 A | 6/1994 | Russek | 6,085,493 A | 7/2000 | DeBusk et al. |
| 5,319,363 A * | 6/1994 | Welch et al. 340/825.36 | 6,088,362 A | 7/2000 | Turnbull et al. |
| 5,357,254 A | 10/1994 | Kah, Jr. | 6,093,146 A | 7/2000 | Filangeri |
| 5,375,604 A | 12/1994 | Kelly et al. | 6,097,308 A | 8/2000 | Albert et al. |
| 5,396,224 A | 3/1995 | Dukes et al. | 6,133,837 A | 10/2000 | Riley |
| 5,396,227 A | 3/1995 | Carroll et al. | 6,147,592 A | 11/2000 | Ulrich et al. |
| 5,416,695 A | 5/1995 | Stutman et al. | 6,183,417 B1 | 2/2001 | Geheb et al. |
| 5,434,775 A | 7/1995 | Sims et al. | 6,208,250 B1 | 3/2001 | Dixon et al. |
| 5,446,678 A | 8/1995 | Saltzstein et al. | 6,241,668 B1 | 6/2001 | Hertzog |
| 5,455,560 A | 10/1995 | Owen | 6,259,355 B1 | 7/2001 | Chaco et al. |
| 5,458,123 A | 10/1995 | Unger | 6,264,614 B1 | 7/2001 | Albert et al. |
| | | | 6,279,183 B1 | 8/2001 | Kummer et al. |
| | | | 6,287,253 B1 | 9/2001 | Ortega et al. |

US 7,852,208 B2

Page 3

| | | | | | |
|--------------|---------|----------------------|-----------------|---------|--------------------------------|
| 6,302,844 B1 | 10/2001 | Walker et al. | 6,731,989 B2 | 5/2004 | Engleson et al. |
| 6,314,556 B1 | 11/2001 | DeBusk et al. | 6,740,033 B1 | 5/2004 | Olejniczak et al. |
| 6,320,510 B2 | 11/2001 | Menkedick et al. | 6,749,566 B2 | 6/2004 | Russ |
| 6,344,794 B1 | 2/2002 | Ulrich et al. | 6,751,630 B1 | 6/2004 | Franks et al. |
| 6,348,777 B1 | 2/2002 | Brown et al. | 6,754,545 B2 | 6/2004 | Haeuser et al. |
| 6,362,725 B1 | 3/2002 | Ulrich et al. | 6,754,883 B2 | 6/2004 | DeBusk et al. |
| 6,364,834 B1 | 4/2002 | Reuss et al. | 6,759,959 B2 | 7/2004 | Wildman |
| 6,398,727 B1 | 6/2002 | Bui et al. | 6,763,541 B2 | 7/2004 | Mahoney et al. |
| 6,406,426 B1 | 6/2002 | Reuss et al. | 6,771,172 B1 | 8/2004 | Robinson et al. |
| 6,407,335 B1 | 6/2002 | Franklin-Lees et al. | 6,773,396 B2 | 8/2004 | Flach et al. |
| 6,412,980 B1 | 7/2002 | Lounsbury et al. | 6,778,225 B2 | 8/2004 | David |
| 6,416,471 B1 | 7/2002 | Kumar et al. | 6,781,517 B2 | 8/2004 | Moster et al. |
| 6,421,649 B1 | 7/2002 | Rattner | 6,784,797 B2 | 8/2004 | Smith et al. |
| 6,439,769 B1 | 8/2002 | Polkus et al. | 6,791,460 B2 | 9/2004 | Dixon et al. |
| 6,441,742 B1 | 8/2002 | Lovely et al. | 6,792,396 B2 | 9/2004 | Inda et al. |
| 6,442,290 B1 | 8/2002 | Ellis et al. | 6,801,227 B2 | 10/2004 | Bocionek et al. |
| 6,445,299 B1 | 9/2002 | Rojas, Jr. | 6,807,543 B2 | 10/2004 | Muthya |
| 6,450,956 B1 | 9/2002 | Rappaport et al. | 6,825,763 B2 | 11/2004 | Ulrich et al. |
| 6,462,656 B2 | 10/2002 | Ulrich et al. | 6,826,578 B2 | 11/2004 | Brackett et al. |
| 6,486,792 B1 | 11/2002 | Moster et al. | 6,828,992 B1 | 12/2004 | Freeman et al. |
| 6,493,568 B1 | 12/2002 | Bell et al. | 6,829,796 B2 | 12/2004 | Salvatini et al. |
| 6,494,831 B1 | 12/2002 | Koritzinsky | 6,830,549 B2 | 12/2004 | Bui et al. |
| 6,510,344 B1 | 1/2003 | Halpern | 6,832,199 B1 | 12/2004 | Kucek et al. |
| 6,516,324 B1 | 2/2003 | Jones et al. | 6,840,117 B2 | 1/2005 | Hubbard, Jr. |
| 6,526,310 B1 | 2/2003 | Carter et al. | 6,847,814 B1 | 1/2005 | Vogeleisen |
| 6,529,164 B1 | 3/2003 | Carter | 6,868,256 B2 | 3/2005 | Dooley et al. |
| 6,533,453 B1 | 3/2003 | Heidsieck et al. | 6,871,211 B2 | 3/2005 | Labounty et al. |
| 6,535,576 B2 | 3/2003 | Vafi et al. | 6,873,884 B2 | 3/2005 | Brackett et al. |
| 6,539,393 B1 | 3/2003 | Kabala | 6,876,985 B2 | 4/2005 | Kawanaka |
| 6,544,173 B2 | 4/2003 | West et al. | 6,885,288 B2 | 4/2005 | Pincus |
| 6,544,174 B2 | 4/2003 | West et al. | 6,891,909 B2 | 5/2005 | Hurley et al. |
| 6,551,243 B2 | 4/2003 | Bocionek et al. | 6,904,161 B1 | 6/2005 | Becker et al. |
| 6,553,106 B1 | 4/2003 | Gould et al. | 6,909,995 B2 | 6/2005 | Shiraishi |
| 6,554,174 B1 | 4/2003 | Aceves | 6,912,549 B2 | 6/2005 | Rotter et al. |
| 6,556,630 B1 | 4/2003 | Brinsfield et al. | 6,915,170 B2 | 7/2005 | Engleson et al. |
| 6,560,274 B1 | 5/2003 | Leitgeb et al. | 6,925,367 B2 | 8/2005 | Fontius |
| 6,572,556 B2 | 6/2003 | Stoycos et al. | 6,930,878 B2 | 8/2005 | Brackett et al. |
| 6,575,901 B2 | 6/2003 | Stoycos et al. | 7,068,143 B2 | 6/2006 | Doering et al. |
| 6,581,204 B2 | 6/2003 | DeBusk et al. | 7,092,376 B2* | 8/2006 | Schuman 370/349 |
| 6,584,182 B2 | 6/2003 | Brodnick | 7,319,386 B2* | 1/2008 | Collins et al. 340/539.12 |
| 6,584,454 B1 | 6/2003 | Hummel, Jr. et al. | 2001/0050610 A1 | 12/2001 | Gelston |
| 6,585,645 B2 | 7/2003 | Hutchinson | 2001/0051765 A1 | 12/2001 | Walker et al. |
| 6,589,170 B1 | 7/2003 | Flach et al. | 2002/0014951 A1 | 2/2002 | Kramer et al. |
| 6,593,528 B2 | 7/2003 | Franklin-Lees et al. | 2002/0044043 A1 | 4/2002 | Chaco et al. |
| 6,594,146 B2 | 7/2003 | Frangesch et al. | 2002/0044059 A1 | 4/2002 | Reeder et al. |
| 6,594,519 B2 | 7/2003 | Stoycos et al. | 2002/0067273 A1 | 6/2002 | Jaques et al. |
| 6,600,421 B2 | 7/2003 | Freeman | 2002/0070867 A1 | 6/2002 | Conway et al. |
| 6,603,494 B1 | 8/2003 | Banks et al. | 2002/0080037 A1 | 6/2002 | Dixon et al. |
| 6,609,115 B1 | 8/2003 | Mehring et al. | 2002/0103674 A1 | 8/2002 | Reeder et al. |
| 6,616,606 B1 | 9/2003 | Petersen et al. | 2002/0151990 A1 | 10/2002 | Ulrich et al. |
| 6,622,088 B2 | 9/2003 | Hood | 2002/0173991 A1 | 11/2002 | Avitall |
| 6,640,246 B1 | 10/2003 | Gary, Jr. et al. | 2002/0186136 A1 | 12/2002 | Schuman |
| 6,643,238 B2 | 11/2003 | Nakajima | 2002/0196141 A1 | 12/2002 | Boone et al. |
| 6,650,346 B1 | 11/2003 | Jaeger et al. | 2003/0010345 A1 | 1/2003 | Koblasz et al. |
| 6,659,947 B1 | 12/2003 | Carter et al. | 2003/0028449 A1 | 2/2003 | Heinen et al. |
| 6,665,385 B2 | 12/2003 | Rogers et al. | 2003/0030569 A1 | 2/2003 | Ulrich et al. |
| 6,665,820 B1 | 12/2003 | Frowein et al. | 2003/0052787 A1 | 3/2003 | Zerhusen et al. |
| 6,669,630 B1 | 12/2003 | Joliat et al. | 2003/0074222 A1 | 4/2003 | Rosow et al. |
| 6,671,547 B2 | 12/2003 | Lyster et al. | 2003/0146835 A1 | 8/2003 | Carter |
| 6,671,563 B1 | 12/2003 | Engelson et al. | 2003/0149598 A1 | 8/2003 | Santoso et al. |
| 6,685,633 B2 | 2/2004 | Albert et al. | 2003/0176798 A1 | 9/2003 | Simon |
| 6,689,091 B2 | 2/2004 | Bui et al. | 2003/0206116 A1 | 11/2003 | Weiner et al. |
| 6,694,367 B1 | 2/2004 | Miesbauer et al. | 2004/0183681 A1 | 9/2004 | Smith |
| 6,694,509 B1 | 2/2004 | Stoval et al. | 2004/0183684 A1 | 9/2004 | Callaway |
| 6,697,765 B2 | 2/2004 | Kuth | 2004/0186358 A1 | 9/2004 | Chernow et al. |
| 6,707,476 B1 | 3/2004 | Hochstedler | 2004/0193449 A1 | 9/2004 | Wildman et al. |
| 6,714,913 B2 | 3/2004 | Brandt et al. | 2005/0035862 A1 | 2/2005 | Wildman et al. |
| 6,721,818 B1 | 4/2004 | Nakamura | 2005/0219059 A1 | 10/2005 | Ulrich et al. |
| 6,726,634 B2 | 4/2004 | Freeman | 2005/0242946 A1 | 11/2005 | Hubbard, Jr. et al. |
| 6,727,818 B1 | 4/2004 | Wildman et al. | 2006/0279427 A1 | 12/2006 | Becker et al. |
| 6,731,311 B2 | 5/2004 | Bufe et al. | | | |

* cited by examiner

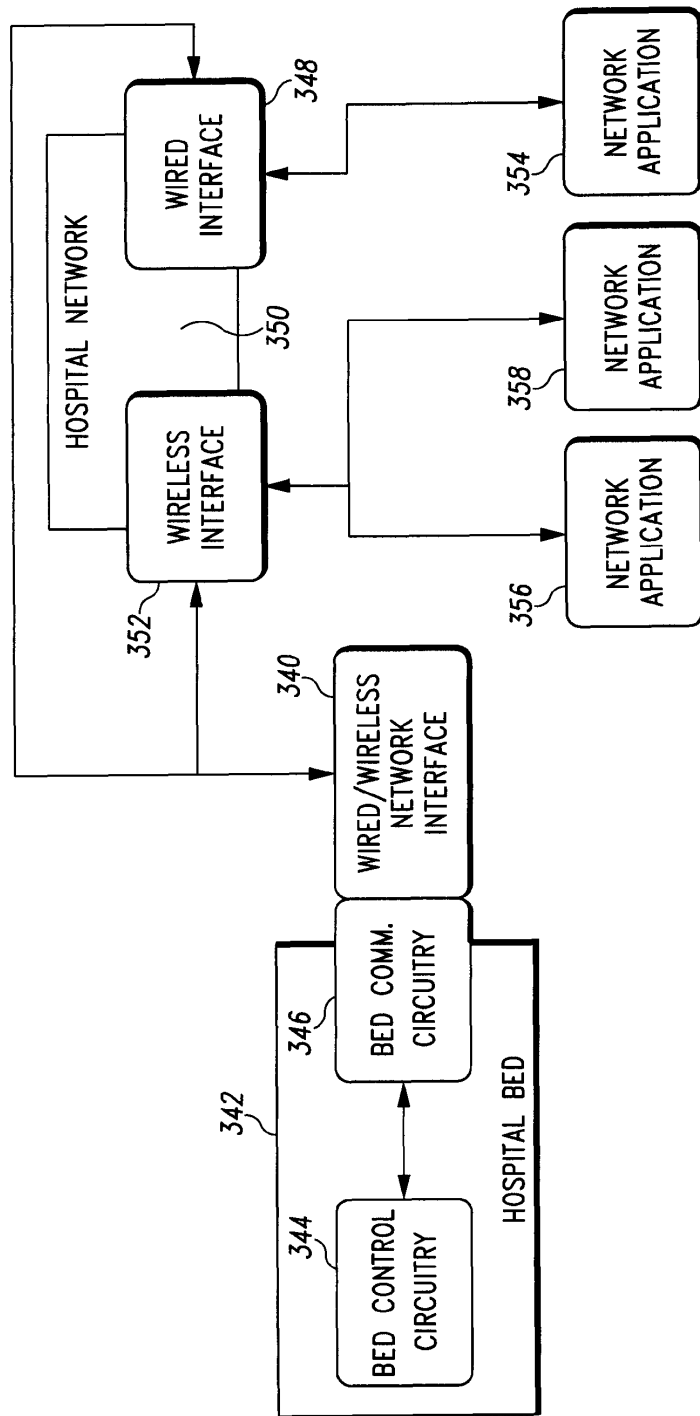


Fig. 1

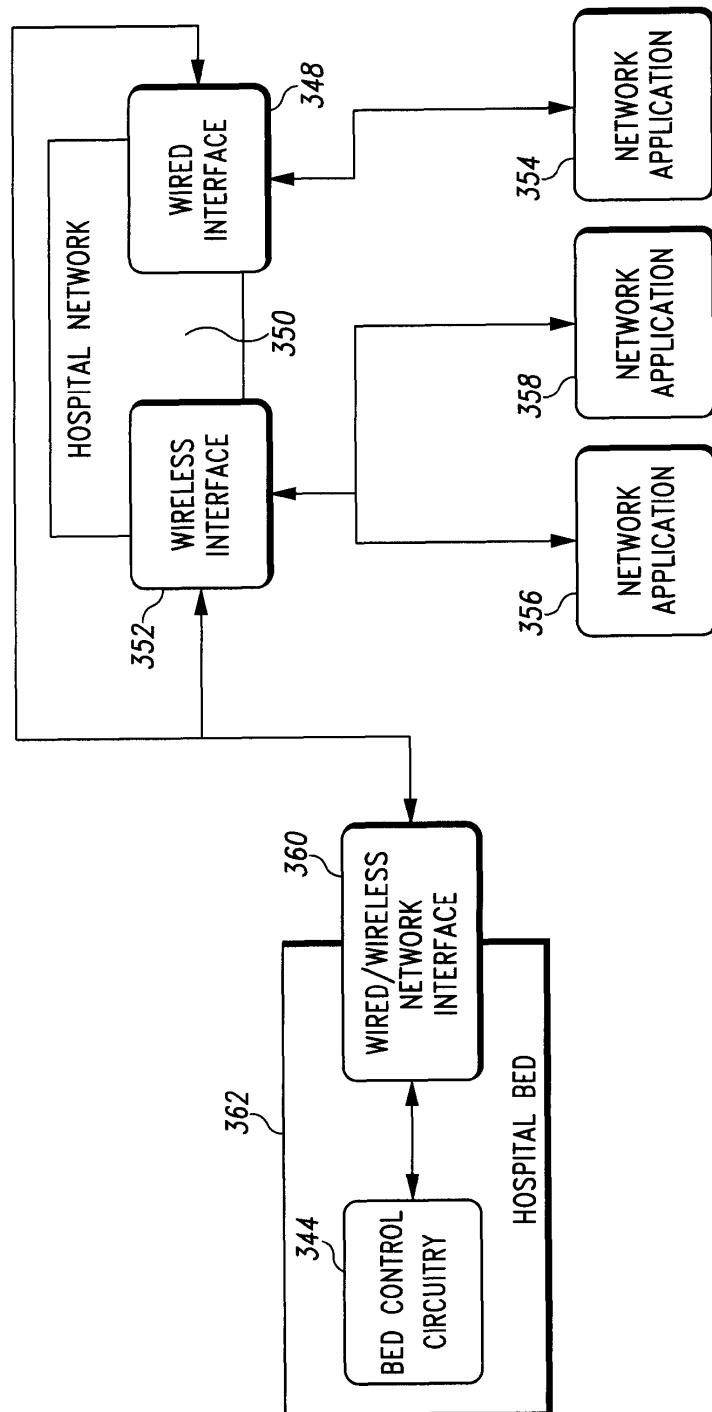


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