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(54) **REMOTE CONTROLLED ROBOT SYSTEM THAT PROVIDES MEDICAL IMAGES**

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USPC 705/2
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(56) **References Cited**

U.S. PATENT DOCUMENTS

4,413,693 A 11/1983 Derby
4,572,594 A 2/1986 Schwartz
4,625,274 A 11/1986 Schroeder
4,638,445 A 1/1987 Mattaboni
4,652,204 A 3/1987 Arnett
4,669,168 A 6/1987 Tamura et al.
4,679,152 A 7/1987 Perdue
4,697,472 A 10/1987 Hiyane

(Continued)

FOREIGN PATENT DOCUMENTS

AU 1216200 A 5/2000
CA 2289697 A1 11/1998

(Continued)

OTHER PUBLICATIONS

Han, et al., "Construction of an Omnidirectional Mobile Robot Platform Based on Active Dual-Wheel Caster Mechanisms and Development of a Control Simulator", 2000, Kluwer Acedemic Publishers, vol. 29, pp. 257-275.

(Continued)

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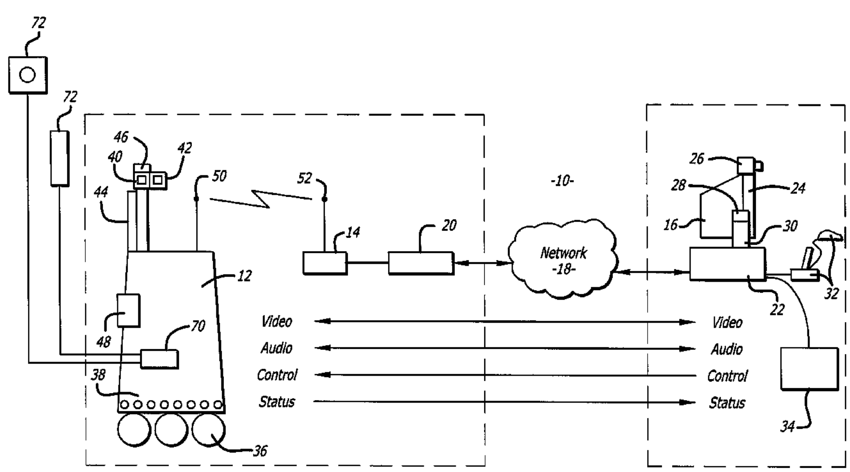
(57) **ABSTRACT**

A remote controlled robot system that includes a mobile robot and a remote control station. The mobile robot is controlled by the remote control station and includes a robot monitor, and a robot camera that captures a robot image. The system also includes a medical image device that can be coupled to the robot. The remote control station includes a camera that captures a remote station image, and a monitor that displays the robot image captured by the robot camera in a robot view field, displays the remote station image in a station view field. The robot transmits the robot and medical images to the remote control station such that a larger portion of a network bandwidth is allocated for the medical image than the robot image.

11 Claims, 5 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

4,709,265	A	11/1987	Silverman et al.
4,751,658	A	6/1988	Kadonoff et al.
4,766,581	A	8/1988	Korn et al.
4,777,416	A	10/1988	George et al.
4,797,557	A	1/1989	Ohman
4,803,625	A	2/1989	Fu et al.
4,847,764	A	7/1989	Halvorson
4,875,172	A	10/1989	Kanayama
4,878,501	A	11/1989	Shue
4,942,512	A	7/1990	Kohno
4,942,538	A	7/1990	Yuan et al.
4,953,159	A	8/1990	Hayden et al.
4,974,607	A	12/1990	Miwa
4,977,971	A	12/1990	Crane, III et al.
5,006,988	A	4/1991	Borenstein et al.
5,040,116	A	8/1991	Evans, Jr. et al.
5,051,906	A	9/1991	Evans et al.
5,073,749	A	12/1991	Kanayama
5,084,828	A	1/1992	Kaufman et al.
5,130,794	A	7/1992	Ritchey
5,148,591	A	9/1992	Pryor
5,153,833	A	10/1992	Gordon et al.
5,155,684	A	10/1992	Burke et al.
5,157,491	A	10/1992	Kassatly
5,182,641	A	1/1993	Diner et al.
5,193,143	A	3/1993	Kaemmerer et al.
5,217,453	A	6/1993	Wilk
5,224,157	A	6/1993	Yamada et al.
5,230,023	A	7/1993	Nakano
5,231,693	A	7/1993	Backes et al.
5,236,432	A	8/1993	Matsen, II et al.
5,315,287	A	5/1994	Sol
5,319,611	A	6/1994	Korba
5,341,242	A	8/1994	Gilboa et al.
5,341,459	A	8/1994	Backes
5,347,306	A	9/1994	Nitta
5,347,457	A	9/1994	Tanaka et al.
5,350,033	A	9/1994	Kraft
5,366,896	A	11/1994	Margrey et al.
5,374,879	A	12/1994	Pin et al.
5,375,195	A	12/1994	Johnston
5,417,210	A	5/1995	Funda et al.
5,436,542	A	7/1995	Petelin et al.
5,441,042	A	8/1995	Putman
5,441,047	A	8/1995	David et al.
5,442,728	A	8/1995	Kaufman et al.
5,462,051	A	10/1995	Oka et al.
5,511,147	A	4/1996	Abdel-Malek
5,528,289	A	6/1996	Cortjens et al.
5,539,741	A	7/1996	Barraclough et al.
5,544,649	A	8/1996	David et al.
5,550,577	A	8/1996	Verbiest et al.
5,553,609	A	9/1996	Chen et al.
5,563,998	A	10/1996	Yaksich et al.
5,572,229	A	11/1996	Fisher
5,572,999	A	11/1996	Funda et al.
5,594,859	A	1/1997	Palmer et al.
5,600,573	A	2/1997	Hendricks et al.
5,636,218	A	6/1997	Ishikawa
5,652,849	A	7/1997	Conway et al.
5,657,246	A	8/1997	Hogan et al.
5,659,779	A	8/1997	Laird et al.
5,673,082	A	9/1997	Wells et al.
5,675,229	A	10/1997	Thorne
5,682,199	A	10/1997	Lankford
5,684,695	A	11/1997	Bauer
5,701,904	A	12/1997	Simmons et al.
5,739,657	A	4/1998	Takayama et al.
5,748,629	A	5/1998	Caldara et al.
5,749,058	A	5/1998	Hashimoto
5,749,362	A	5/1998	Funda et al.
5,754,631	A	5/1998	Cave
5,758,079	A	5/1998	Ludwig et al.
5,762,458	A	6/1998	Wang et al.
5,764,731	A	6/1998	Yablon
5,767,897	A	6/1998	Howell
5,786,846	A	7/1998	Hiroaki
5,787,545	A	8/1998	Collens
5,802,494	A	9/1998	Kuno
5,836,872	A	11/1998	Kenet et al.
5,867,653	A	2/1999	Aras et al.
5,876,325	A	3/1999	Mizuno et al.
5,911,036	A	6/1999	Wright et al.
5,917,958	A	6/1999	Nunally et al.
5,927,423	A	7/1999	Wada et al.
5,949,758	A	9/1999	Kober et al.
5,954,692	A	9/1999	Smith et al.
5,959,423	A	9/1999	Nakanishi et al.
5,961,446	A	10/1999	Beller et al.
5,966,130	A	10/1999	Benman, Jr.
5,973,724	A	10/1999	Riddle
5,974,446	A	10/1999	Sonnenreich et al.
5,983,263	A	11/1999	Rothrock et al.
5,995,119	A	11/1999	Cosatto et al.
5,995,884	A	11/1999	Allen et al.
5,999,977	A	12/1999	Riddle
6,031,845	A	2/2000	Walding
6,047,259	A	4/2000	Campbell et al.
6,113,343	A	9/2000	Goldenberg et al.
6,133,944	A	10/2000	Braun et al.
6,135,228	A	10/2000	Asada et al.
6,148,100	A	11/2000	Anderson et al.
6,160,582	A	12/2000	Hill
6,170,929	B1	1/2001	Wilson et al.
6,175,779	B1	1/2001	Barrett
6,201,984	B1	3/2001	Funda et al.
6,211,903	B1	4/2001	Bullister
6,219,587	B1	4/2001	Ahlin et al.
6,232,735	B1	5/2001	Baba et al.
6,233,504	B1	5/2001	Das et al.
6,233,735	B1	5/2001	Ebihara
6,250,928	B1	6/2001	Poggio et al.
6,256,556	B1	7/2001	Zenke
6,259,806	B1	7/2001	Green
6,259,956	B1	7/2001	Myers et al.
6,266,162	B1	7/2001	Okamura et al.
6,266,577	B1	7/2001	Popp et al.
6,289,263	B1	9/2001	Mukherjee
6,292,713	B1	9/2001	Jouppi et al.
6,304,050	B1	10/2001	Skaar et al.
6,317,652	B1	11/2001	Osada
6,321,137	B1	11/2001	De Smet
6,324,184	B1	11/2001	Hou et al.
6,324,443	B1	11/2001	Kurakake et al.
6,325,756	B1	12/2001	Webb et al.
6,327,516	B1	12/2001	Zenke
6,330,486	B1	12/2001	Padula
6,330,493	B1	12/2001	Takahashi et al.
6,346,950	B1	2/2002	Jouppi
6,346,962	B1	2/2002	Goodridge
6,369,847	B1	4/2002	James et al.
6,381,515	B1	4/2002	Inoue et al.
6,400,378	B1	6/2002	Snook
6,408,230	B2	6/2002	Wada
6,430,471	B1	8/2002	Kintou et al.
6,430,475	B2	8/2002	Okamoto et al.
6,438,457	B1	8/2002	Yokoo et al.
6,445,964	B1	9/2002	White et al.
6,452,915	B1	9/2002	Jorgensen
6,457,043	B1	9/2002	Kwak et al.
6,459,955	B1	10/2002	Bartsch et al.
6,463,352	B1	10/2002	Tadokoro et al.
6,463,361	B1	10/2002	Wang et al.
6,466,844	B1	10/2002	Ikeda et al.
6,468,265	B1	10/2002	Evans et al.
6,470,235	B2	10/2002	Kasuga et al.
6,480,762	B1	11/2002	Uchikubo et al.
6,491,701	B2	12/2002	Tierney et al.
6,496,099	B2	12/2002	Wang et al.
6,496,755	B2	12/2002	Wallach et al.
6,501,740	B1	12/2002	Sun et al.
6,507,773	B2	1/2003	Parker et al.
6,522,906	B1	2/2003	Salisbury et al.
6,523,629	B1	2/2003	Buttz et al.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,526,332	B2	2/2003	Sakamoto et al.	
6,529,765	B1	3/2003	Franck et al.	
6,529,802	B1	3/2003	Kawakita et al.	
6,532,404	B2	3/2003	Colens	
6,535,182	B2	3/2003	Stanton	
6,535,793	B2	3/2003	Allard	
6,540,039	B1	4/2003	Yu et al.	
6,543,899	B2	4/2003	Covannon et al.	
6,549,215	B2	4/2003	Jouppi	
6,563,533	B1	5/2003	Colby	
6,580,246	B2	6/2003	Jacobs	
6,584,376	B1	6/2003	Van Kommer	
6,594,269	B1	7/2003	Polcyn	
6,602,469	B1	8/2003	Maus et al.	
6,604,019	B2	8/2003	Ahlin et al.	
6,604,021	B2	8/2003	Imai et al.	
6,611,120	B2	8/2003	Song et al.	
6,643,496	B1	11/2003	Shimoyama et al.	
6,646,677	B2	11/2003	Noro et al.	
6,650,748	B1	11/2003	Edwards et al.	
6,684,129	B2	1/2004	Salisbury et al.	
6,691,000	B2	2/2004	Nagai et al.	
6,710,797	B1	3/2004	McNelley et al.	
6,728,599	B2	4/2004	Wang et al.	
6,763,282	B2	7/2004	Glenn et al.	
6,764,373	B1	7/2004	Osawa et al.	
6,769,771	B2	8/2004	Trumbull	
6,781,606	B2	8/2004	Jouppi	
6,784,916	B2	8/2004	Smith	
6,785,589	B2	8/2004	Eggenberger et al.	
6,791,550	B2	9/2004	Goldhor et al.	
6,798,753	B1	9/2004	Doganata et al.	
6,799,065	B1	9/2004	Niemeyer	
6,799,088	B2	9/2004	Wang et al.	
6,804,580	B1	10/2004	Stoddard et al.	
6,804,656	B1	10/2004	Rosenfeld et al.	
6,810,411	B1	10/2004	Coughlin et al.	
6,836,703	B2	12/2004	Wang et al.	
6,839,612	B2	1/2005	Sanchez et al.	
6,840,904	B2	1/2005	Goldberg	
6,845,297	B2	1/2005	Allard	
6,852,107	B2	2/2005	Wang et al.	
6,853,878	B2	2/2005	Hirayama et al.	
6,853,880	B2	2/2005	Sakagami et al.	
6,871,117	B2	3/2005	Wang et al.	
6,879,879	B2	4/2005	Jouppi et al.	
6,888,333	B2	5/2005	Laby	
6,892,112	B2	5/2005	Wang et al.	
6,895,305	B2	5/2005	Lathan et al.	
6,898,484	B2	5/2005	Lemelson et al.	
6,914,622	B1	7/2005	Smith et al.	
6,925,357	B2	8/2005	Wang et al.	
6,951,535	B2	10/2005	Ghodoussi et al.	
6,952,470	B1	10/2005	Tioe	
6,957,712	B2	10/2005	Song et al.	
6,958,706	B2	10/2005	Chaco et al.	
6,965,394	B2	11/2005	Gutta et al.	
6,995,664	B1	2/2006	Darling	
7,007,235	B1	2/2006	Hussein et al.	
7,015,934	B2	3/2006	Toyama et al.	
RE39,080	E	4/2006	Johnston	
7,030,757	B2	4/2006	Matsuhira et al.	
7,058,689	B2	6/2006	Parker et al.	
7,092,001	B2	8/2006	Schulz	
7,096,090	B1	8/2006	Zweig	
7,115,102	B2	10/2006	Abbruscato	
7,117,067	B2	10/2006	McLurkin et al.	
7,123,285	B2	10/2006	Smith et al.	
7,123,974	B1	10/2006	Hamilton	
7,123,991	B2	10/2006	Graf et al.	
7,127,325	B2	10/2006	Nagata et al.	
7,129,970	B2	10/2006	James et al.	
7,133,062	B2	11/2006	Castles et al.	
7,142,945	B2	11/2006	Wang et al.	
7,142,947	B2	11/2006	Wang et al.	
7,151,982	B2	12/2006	Liff et al.	
7,154,526	B2	12/2006	Foote et al.	
7,155,306	B2	12/2006	Haitin et al.	
7,156,809	B2	1/2007	Quy	
7,158,859	B2	1/2007	Wang et al.	
7,158,860	B2	1/2007	Wang et al.	
7,158,861	B2	1/2007	Wang et al.	
7,161,322	B2	1/2007	Wang et al.	
7,162,338	B2	1/2007	Goncalves et al.	
7,164,969	B2	1/2007	Wang et al.	
7,164,970	B2	1/2007	Wang et al.	
7,167,448	B2	1/2007	Wookey et al.	
7,171,286	B2	1/2007	Wang et al.	
7,174,238	B1	2/2007	Zweig	
7,181,455	B2	2/2007	Wookey et al.	
7,184,559	B2	2/2007	Jouppi	
7,188,000	B2	3/2007	Chiappetta et al.	
7,199,790	B2	4/2007	Rosenberg et al.	
7,202,851	B2	4/2007	Cunningham et al.	
7,206,627	B2	4/2007	Abovitz et al.	
7,215,786	B2	5/2007	Nakadai et al.	
7,227,334	B2	6/2007	Yang et al.	
7,256,708	B2	8/2007	Rosenfeld	
7,262,573	B2	8/2007	Wang et al.	
7,289,883	B2	10/2007	Wang et al.	
7,292,912	B2	11/2007	Wang et al.	
7,317,685	B1	1/2008	Flott et al.	
7,321,807	B2	1/2008	Laski	
7,346,429	B2	3/2008	Goldenberg et al.	
7,382,399	B1	6/2008	McCall	
7,386,730	B2	6/2008	Uchikubo	
7,391,432	B2	6/2008	Terado	
7,400,578	B2	7/2008	Guthrie et al.	
7,404,140	B2	7/2008	O'Rourke	
7,421,470	B2	9/2008	Ludwig et al.	
7,430,209	B2	9/2008	Porter	
7,432,949	B2	10/2008	Remy et al.	
7,433,921	B2	10/2008	Ludwig et al.	
7,441,953	B2 *	10/2008	Banks	378/197
7,492,731	B2	2/2009	Hagendorf	
7,523,069	B1	4/2009	Friedl et al.	
7,525,281	B2	4/2009	Koyanagi et al.	
7,535,486	B2	5/2009	Motomura et al.	
7,587,512	B2	9/2009	Ta et al.	
7,590,060	B2	9/2009	Miceli	
7,593,030	B2	9/2009	Wang et al.	
7,599,290	B2	10/2009	Dos Remedios et al.	
7,624,166	B2	11/2009	Foote et al.	
7,630,314	B2	12/2009	Dos Remedios et al.	
7,643,051	B2	1/2010	Sandberg et al.	
7,647,320	B2	1/2010	Mok et al.	
7,680,038	B1	3/2010	Gourlay	
7,693,757	B2	4/2010	Zimmerman	
7,698,432	B2	4/2010	Short et al.	
7,719,229	B2	5/2010	Kaneko et al.	
7,739,383	B1	6/2010	Short et al.	
7,756,614	B2	7/2010	Jouppi	
7,761,185	B2	7/2010	Wang et al.	
7,769,492	B2	8/2010	Wang et al.	
7,769,705	B1	8/2010	Luechtefeld	
7,813,836	B2	10/2010	Wang et al.	
7,831,575	B2	11/2010	Trossell et al.	
7,835,775	B2	11/2010	Sawayama et al.	
7,860,680	B2	12/2010	Arms et al.	
7,890,382	B2	2/2011	Robb et al.	
7,912,583	B2	3/2011	Gutmann et al.	
RE42,288	E	4/2011	Degioanni	
7,924,323	B2	4/2011	Walker et al.	
7,949,616	B2	5/2011	Levy et al.	
7,982,763	B2	7/2011	King	
7,987,069	B2	7/2011	Rodgers et al.	
8,077,963	B2	12/2011	Wang et al.	
8,116,910	B2	2/2012	Walters et al.	
8,170,241	B2	5/2012	Roe et al.	
8,179,418	B2	5/2012	Wright et al.	
8,180,486	B2	5/2012	Saito et al.	
8,209,051	B2	6/2012	Wang et al.	
8,265,793	B2	9/2012	Cross et al.	
8,292,807	B2	10/2012	Perkins et al.	

(56) **References Cited**

U.S. PATENT DOCUMENTS

8,340,654	B2	12/2012	Bratton et al.	
8,340,819	B2	12/2012	Mangaser et al.	
8,463,435	B2	6/2013	Herzog et al.	
8,503,340	B1	8/2013	Xu	
8,527,094	B2	9/2013	Kumar et al.	
8,532,860	B2	9/2013	Daly	
2001/0002448	A1	5/2001	Wilson et al.	
2001/0010053	A1	7/2001	Ben-Shachar et al.	
2001/0020200	A1	9/2001	Das et al.	
2001/0034475	A1	10/2001	Flach et al.	
2001/0034544	A1	10/2001	Mo	
2001/0037163	A1	11/2001	Allard	
2001/0048464	A1	12/2001	Barnett	
2001/0051881	A1	12/2001	Filler	
2001/0054071	A1	12/2001	Loeb	
2001/0055373	A1	12/2001	Yamashita	
2002/0015296	A1	2/2002	Howell	
2002/0027597	A1	3/2002	Sachau	
2002/0027652	A1	3/2002	Paromtchik et al.	
2002/0033880	A1	3/2002	Sul et al.	
2002/0038168	A1	3/2002	Kasuga et al.	
2002/0049517	A1	4/2002	Ruffner	
2002/0055917	A1 *	5/2002	Muraca	707/1
2002/0057279	A1	5/2002	Jouppi	
2002/0058929	A1	5/2002	Green	
2002/0059587	A1	5/2002	Cofano et al.	
2002/0063726	A1	5/2002	Jouppi	
2002/0073429	A1	6/2002	Beane et al.	
2002/0082498	A1	6/2002	Wendt et al.	
2002/0085030	A1	7/2002	Ghani	
2002/0095238	A1	7/2002	Ahlin et al.	
2002/0095239	A1	7/2002	Wallach et al.	
2002/0098879	A1	7/2002	Rheey	
2002/0104094	A1	8/2002	Alexander et al.	
2002/0109770	A1	8/2002	Terada	
2002/0111988	A1	8/2002	Sato	
2002/0120362	A1	8/2002	Lathan et al.	
2002/0130950	A1	9/2002	James et al.	
2002/0133062	A1	9/2002	Arling et al.	
2002/0141595	A1	10/2002	Jouppi	
2002/0143923	A1	10/2002	Alexander	
2002/0177925	A1	11/2002	Onishi et al.	
2002/0183894	A1	12/2002	Wang et al.	
2002/0184674	A1	12/2002	Xi et al.	
2002/0186243	A1	12/2002	Ellis et al.	
2003/0021107	A1	1/2003	Howell et al.	
2003/0030397	A1	2/2003	Simmons	
2003/0048481	A1	3/2003	Kobayashi	
2003/0050733	A1	3/2003	Wang et al.	
2003/0050734	A1	3/2003	Lapham	
2003/0060808	A1	3/2003	Wilk	
2003/0063600	A1	4/2003	Noma et al.	
2003/0069752	A1	4/2003	Ledain et al.	
2003/0100892	A1	5/2003	Morley et al.	
2003/0104806	A1	6/2003	Ruef et al.	
2003/0114962	A1	6/2003	Niemeyer	
2003/0126361	A1	7/2003	Slater et al.	
2003/0135203	A1	7/2003	Wang et al.	
2003/0144579	A1	7/2003	Buss	
2003/0144649	A1	7/2003	Ghodoussi et al.	
2003/0151658	A1	8/2003	Smith	
2003/0152145	A1	8/2003	Kawakita	
2003/0171710	A1	9/2003	Bassuk et al.	
2003/0174285	A1	9/2003	Trumbull	
2003/0180697	A1	9/2003	Kim et al.	
2003/0199000	A1	10/2003	Valkirs et al.	
2003/0206242	A1	11/2003	Choi et al.	
2003/0212472	A1	11/2003	McKee	
2003/0216834	A1	11/2003	Allard	
2003/0220541	A1	11/2003	Salisbury et al.	
2003/0220715	A1	11/2003	Kneifel, II et al.	
2003/0231244	A1	12/2003	Bonilla et al.	
2003/0232649	A1	12/2003	Gizis	
2003/0236590	A1	12/2003	Park et al.	
2004/0001197	A1	1/2004	Ko et al.	
2004/0001676	A1	1/2004	Colgan et al.	
2004/0010344	A1	1/2004	Hiratsuka	
2004/0012362	A1	1/2004	Tsurumi	
2004/0013295	A1	1/2004	Sabe et al.	
2004/0019406	A1 *	1/2004	Wang et al.	700/231
2004/0024490	A1	2/2004	McLurkin et al.	
2004/0041904	A1	3/2004	Lapalme et al.	
2004/0065073	A1	4/2004	Nash	
2004/0068657	A1	4/2004	Alexander et al.	
2004/0078219	A1	4/2004	Kaylor et al.	
2004/0080610	A1	4/2004	James et al.	
2004/0088077	A1	5/2004	Jouppi et al.	
2004/0093409	A1	5/2004	Thompson et al.	
2004/0095516	A1	5/2004	Rohlicek	
2004/0098167	A1	5/2004	Yi et al.	
2004/0102167	A1	5/2004	Shim et al.	
2004/0107254	A1	6/2004	Ludwig et al.	
2004/0107255	A1	6/2004	Ludwig et al.	
2004/0117065	A1	6/2004	Wang et al.	
2004/0123158	A1	6/2004	Roskind	
2004/0135879	A1	7/2004	Stacy et al.	
2004/0138547	A1	7/2004	Wang et al.	
2004/0143421	A1	7/2004	Wang et al.	
2004/0148638	A1	7/2004	Weisman et al.	
2004/0153211	A1	8/2004	Kamoto et al.	
2004/0157612	A1	8/2004	Kim	
2004/0162637	A1	8/2004	Wang et al.	
2004/0167666	A1	8/2004	Wang et al.	
2004/0167668	A1	8/2004	Wang et al.	
2004/0170300	A1	9/2004	Jouppi	
2004/0172301	A1	9/2004	Mihai et al.	
2004/0172306	A1	9/2004	Wohl et al.	
2004/0174129	A1	9/2004	Wang et al.	
2004/0175684	A1	9/2004	Kaasa et al.	
2004/0179714	A1	9/2004	Jouppi	
2004/0186623	A1	9/2004	Dooley et al.	
2004/0189700	A1	9/2004	Mandavilli et al.	
2004/0201602	A1	10/2004	Mody et al.	
2004/0205664	A1	10/2004	Prendergast	
2004/0215490	A1	10/2004	Duchon et al.	
2004/0222638	A1	11/2004	Bednyak	
2004/0224676	A1	11/2004	Iseki	
2004/0230340	A1	11/2004	Fukuchi et al.	
2004/0240981	A1	12/2004	Dothan et al.	
2005/0003330	A1	1/2005	Asgarinejad	
2005/0004708	A1	1/2005	Goldenberg et al.	
2005/0007445	A1	1/2005	Foote et al.	
2005/0013149	A1	1/2005	Trossell	
2005/0021182	A1	1/2005	Wang et al.	
2005/0021183	A1	1/2005	Wang et al.	
2005/0021187	A1	1/2005	Wang et al.	
2005/0021309	A1	1/2005	Alexander et al.	
2005/0024485	A1 *	2/2005	Castles et al.	348/14.03
2005/0027567	A1	2/2005	Taha	
2005/0027794	A1	2/2005	Decker	
2005/0028221	A1	2/2005	Liu et al.	
2005/0035862	A1	2/2005	Wildman et al.	
2005/0038416	A1	2/2005	Wang et al.	
2005/0038564	A1	2/2005	Burick et al.	
2005/0049898	A1	3/2005	Hirakawa	
2005/0052527	A1 *	3/2005	Remy et al.	348/14.08
2005/0060211	A1	3/2005	Xiao et al.	
2005/0065438	A1	3/2005	Miller	
2005/0065659	A1	3/2005	Tanaka et al.	
2005/0065813	A1	3/2005	Mishelevich et al.	
2005/0071046	A1	3/2005	Miyazaki et al.	
2005/0078816	A1	4/2005	Sekiguchi et al.	
2005/0083011	A1	4/2005	Yang et al.	
2005/0099493	A1	5/2005	Chew	
2005/0104964	A1	5/2005	Bovyrin et al.	
2005/0110867	A1	5/2005	Schultz	
2005/0122390	A1	6/2005	Wang et al.	
2005/0125098	A1	6/2005	Wang et al.	
2005/0154265	A1	7/2005	Miro et al.	
2005/0182322	A1	8/2005	Grispo	
2005/0192721	A1	9/2005	Jouppi	
2005/0204438	A1	9/2005	Wang et al.	
2005/0212478	A1	9/2005	Takenaka	
2005/0219356	A1	10/2005	Smith et al.	

(56) **References Cited**

U.S. PATENT DOCUMENTS

2005/0225634 A1 10/2005 Brunetti et al.
2005/0231156 A1 10/2005 Yan
2005/0231586 A1 10/2005 Rodman et al.
2005/0232647 A1 10/2005 Takenaka
2005/0234592 A1 10/2005 McGee et al.
2005/0267826 A1 12/2005 Levy et al.
2005/0283414 A1 12/2005 Fernandes et al.
2006/0007943 A1 1/2006 Fellman
2006/0013263 A1 1/2006 Fellman
2006/0013469 A1 1/2006 Wang et al.
2006/0014388 A1 1/2006 Lur et al.
2006/0020694 A1 1/2006 Nag et al.
2006/0029065 A1 2/2006 Fellman
2006/0047365 A1 3/2006 Ghodoussi et al.
2006/0048286 A1 3/2006 Donato
2006/0052676 A1 3/2006 Wang et al.
2006/0052684 A1 3/2006 Takahashi et al.
2006/0064212 A1 3/2006 Thorne
2006/0074525 A1 4/2006 Close et al.
2006/0074719 A1 4/2006 Horner
2006/0082642 A1 4/2006 Wang et al.
2006/0087746 A1 4/2006 Lipow
2006/0095158 A1 5/2006 Lee et al.
2006/0095170 A1 5/2006 Yang et al.
2006/0098573 A1 5/2006 Beer et al.
2006/0103659 A1 5/2006 Karandikar et al.
2006/0104279 A1 5/2006 Fellman et al.
2006/0106493 A1 5/2006 Niemeyer et al.
2006/0122482 A1 6/2006 Mariotti et al.
2006/0125356 A1 6/2006 Meek et al.
2006/0142881 A1 6/2006 Wang et al.
2006/0142983 A1 6/2006 Sorensen
2006/0149418 A1 7/2006 Anvari
2006/0161136 A1 7/2006 Anderson et al.
2006/0161303 A1 7/2006 Wang et al.
2006/0164546 A1 7/2006 Adachi et al.
2006/0171515 A1 8/2006 Hintermeister et al.
2006/0173708 A1 8/2006 Vining et al.
2006/0173712 A1 8/2006 Joubert
2006/0178776 A1 8/2006 Feingold et al.
2006/0178777 A1 8/2006 Park et al.
2006/0189393 A1 8/2006 Edery
2006/0195569 A1 8/2006 Barker
2006/0224781 A1 10/2006 Tsao et al.
2006/0247045 A1 11/2006 Jeong et al.
2006/0259193 A1 11/2006 Wang et al.
2006/0268704 A1 11/2006 Ansari et al.
2006/0271238 A1 11/2006 Choi et al.
2006/0271400 A1 11/2006 Clements et al.
2006/0293788 A1 12/2006 Pogodin
2007/0021871 A1 1/2007 Wang et al.
2007/0025711 A1 2/2007 Marcus
2007/0046237 A1 3/2007 Lakshmanan et al.
2007/0050937 A1 3/2007 Song et al.
2007/0064092 A1 3/2007 Sandberg et al.
2007/0078566 A1 4/2007 Wang et al.
2007/0112700 A1 5/2007 Den et al.
2007/0117516 A1 5/2007 Saidi et al.
2007/0120965 A1 5/2007 Sandberg et al.
2007/0122783 A1 5/2007 Habashi
2007/0133407 A1 6/2007 Choi et al.
2007/0135967 A1 6/2007 Jung et al.
2007/0142964 A1 6/2007 Abramson
2007/0176060 A1 8/2007 White et al.
2007/0192910 A1 8/2007 Vu et al.
2007/0197896 A1 8/2007 Moll et al.
2007/0198128 A1 8/2007 Ziegler et al.
2007/0198130 A1 8/2007 Wang et al.
2007/0199108 A1 8/2007 Angle et al.
2007/0216347 A1 9/2007 Kaneko et al.
2007/0250212 A1 10/2007 Halloran et al.
2007/0255706 A1 11/2007 Iketani et al.
2007/0262884 A1 11/2007 Goncalves et al.
2007/0273751 A1 11/2007 Sachau
2007/0291109 A1 12/2007 Wang et al.
2007/0291128 A1 12/2007 Wang et al.
2008/0009969 A1 1/2008 Bruemmer et al.
2008/0011904 A1 1/2008 Cepollina et al.
2008/0045804 A1 2/2008 Williams
2008/0065268 A1 3/2008 Wang et al.
2008/0082211 A1 4/2008 Wang et al.
2008/0126132 A1 5/2008 Warner et al.
2008/0133052 A1 6/2008 Jones et al.
2008/0174570 A1 7/2008 Jobs et al.
2008/0201016 A1* 8/2008 Finlay 700/259
2008/0201017 A1 8/2008 Wang et al.
2008/0215987 A1 9/2008 Alexander et al.
2008/0229531 A1 9/2008 Takida
2008/0255703 A1 10/2008 Wang et al.
2008/0263451 A1 10/2008 Portele et al.
2008/0269949 A1 10/2008 Norman et al.
2008/0281467 A1 11/2008 Pinter
2008/0306375 A1 12/2008 Sayler et al.
2009/0030552 A1 1/2009 Nakadai et al.
2009/0044334 A1 2/2009 Parsell et al.
2009/0055023 A1 2/2009 Walters et al.
2009/0070135 A1 3/2009 Parida et al.
2009/0086013 A1 4/2009 Thapa
2009/0105882 A1 4/2009 Wang et al.
2009/0106679 A1 4/2009 Anzures et al.
2009/0122699 A1 5/2009 Alperovitch et al.
2009/0125147 A1 5/2009 Wang et al.
2009/0144425 A1 6/2009 Marr et al.
2009/0164255 A1 6/2009 Menschik et al.
2009/0164657 A1 6/2009 Li et al.
2009/0171170 A1 7/2009 Li et al.
2009/0177323 A1 7/2009 Ziegler et al.
2009/0177641 A1 7/2009 Raghavan
2009/0237317 A1 9/2009 Rofougaran
2009/0240371 A1 9/2009 Wang et al.
2009/0248200 A1 10/2009 Root
2009/0259339 A1 10/2009 Wright et al.
2010/0010672 A1 1/2010 Wang et al.
2010/0010673 A1 1/2010 Wang et al.
2010/0019715 A1 1/2010 Roe et al.
2010/0051596 A1 3/2010 Diedrick et al.
2010/0063848 A1 3/2010 Kremer et al.
2010/0070079 A1 3/2010 Mangaser et al.
2010/0073490 A1 3/2010 Wang et al.
2010/0076600 A1 3/2010 Cross et al.
2010/0085874 A1 4/2010 Noy et al.
2010/0088232 A1 4/2010 Gale
2010/0115418 A1 5/2010 Wang et al.
2010/0116566 A1 5/2010 Ohm et al.
2010/0131103 A1 5/2010 Herzog et al.
2010/0145479 A1 6/2010 Griffiths
2010/0157825 A1 6/2010 Anderlind et al.
2010/0191375 A1 7/2010 Wright et al.
2010/0228249 A1 9/2010 Mohr et al.
2010/0268383 A1 10/2010 Wang et al.
2010/0323783 A1 12/2010 Nonaka et al.
2011/0050841 A1 3/2011 Wang et al.
2011/0071702 A1 3/2011 Wang et al.
2011/0172822 A1 7/2011 Ziegler et al.
2011/0187875 A1 8/2011 Sanchez et al.
2011/0190930 A1 8/2011 Hanrahan et al.
2011/0213210 A1 9/2011 Temby et al.
2011/0218674 A1 9/2011 Stuart et al.
2011/0245973 A1 10/2011 Wang et al.
2011/0292193 A1 12/2011 Wang et al.
2011/0301759 A1 12/2011 Wang et al.
2012/0023506 A1 1/2012 Maeckel et al.
2012/0036484 A1 2/2012 Zhang et al.
2012/0072023 A1 3/2012 Ota
2012/0072024 A1 3/2012 Wang et al.
2012/0092157 A1 4/2012 Tran
2012/0095352 A1 4/2012 Tran
2012/0191246 A1 7/2012 Roe et al.
2012/0191464 A1 7/2012 Stuart et al.

FOREIGN PATENT DOCUMENTS

CN 1554193 A 12/2004
CN 1554985 A 12/2004

(56) **References Cited**

FOREIGN PATENT DOCUMENTS

CN	101106939	A	1/2008
CN	101390098	A	3/2009
CN	101507260	A	8/2009
CN	101730894	A	6/2010
CN	101866396	A	10/2010
CN	101978365	A	2/2011
CN	102203759	A	9/2011
CN	101106939	B	11/2011
EP	92/466492	A2	1/1992
EP	92/488673	A2	6/1992
EP	0981905	B1	1/2002
EP	1 262 142	A2	12/2002
EP	1304872	A1	4/2003
EP	1 536 660	B2	9/2004
EP	1 536 660	A2	6/2005
EP	2005/1573406	A2	9/2005
EP	2005/1594660	A2	11/2005
EP	1763243	A2	3/2007
EP	2007/1791464	A2	6/2007
EP	2007/1800476	A2	6/2007
EP	1819108	A2	8/2007
EP	2007/1856644	A2	11/2007
EP	1536660	A3	4/2008
EP	2008/1928310	A2	6/2008
EP	1232610	B1	1/2009
EP	20092027716	A2	2/2009
EP	2010/2145274	A1	1/2010
EP	2010/2214111	A2	8/2010
EP	2010/2263158	A2	12/2010
EP	2011/2300930	A2	3/2011
EP	2300930	A1	3/2011
EP	2011/2342651	A2	7/2011
GB	2431261	A	4/2007
JP	07-194609	A	8/1995
JP	2007-213753	A	8/1995
JP	2007-248823	A	8/1995
JP	2007-257422	A	10/1995
JP	08084328	A	3/1996
JP	H0884328		3/1996
JP	96/8320727	A	12/1996
JP	9-267276	A	10/1997
JP	10079097	A	3/1998
JP	10288689	A	10/1998
JP	2000-032319	A	1/2000
JP	2000/049800	A	2/2000
JP	2000/079587	A	3/2000
JP	2000/196876	A	7/2000
JP	2000-235423	A	8/2000
JP	2001/188124	A	4/2001
JP	2001/125641	A	5/2001
JP	2001-147718	A	5/2001
JP	2001/179663	A	7/2001
JP	2001-198865	A	7/2001
JP	2001-198868	A	7/2001
JP	2001-199356	A	7/2001
JP	2002-000574	A	1/2002
JP	2002-046088	A	2/2002
JP	2002/112970	A	4/2002
JP	2002/101333	A	5/2002
JP	2002-305743	A	10/2002
JP	2002-355779	A	12/2002
JP	2004/524824	T	8/2004
JP	2004-261941	A	9/2004
JP	2004/289379	A	10/2004
JP	2005/028066	A	2/2005
JP	2005/059170	A	3/2005
JP	2006/508806	A	3/2006
JP	2006/109094	A	4/2006
JP	2006/224294	A	8/2006
JP	2006/246438	A	9/2006
JP	2007-007040	A	1/2007
JP	2007/081646	A	3/2007
JP	2007-232208	A	9/2007
JP	2007-316966	A	12/2007
JP	2010/064154	A	3/2010
JP	2010/532109	A	9/2010
JP	2010/246954	A	11/2010
KR	2006/0037979	A	5/2006
KR	2009/0012542	A	2/2009
KR	2010/0019479	A	2/2010
KR	2010/0139037	A	12/2010
WO	WO 93-06690	A1	4/1993
WO	WO 98-51078	A	11/1998
WO	WO 99/67067	A1	12/1999
WO	00/25516	A1	5/2000
WO	00/33726	A3	6/2000
WO	01/31861	A1	5/2001
WO	WO 03/077745	A	9/2003
WO	2004/008738	A1	1/2004
WO	2004/012018	A2	2/2004
WO	WO 2004/075456	A2	9/2004
WO	2006/012797	A1	2/2006
WO	2006/078611	A1	4/2006
WO	2006044847	A2	4/2006
WO	WO 2007/041295	A1	9/2006
WO	2007/041295	A2	4/2007
WO	2007/041038	A1	6/2007
WO	2008/100272	A2	8/2008
WO	2008/100272	A3	10/2008
WO	2009/117274	A2	9/2009
WO	2009/128997	A1	10/2009
WO	2009/145958	A2	12/2009
WO	2010/006205	A1	1/2010
WO	2010/006211	A1	1/2010
WO	2010/033666	A1	3/2010
WO	2010/047881	A1	4/2010
WO	2010/062798	A1	6/2010
WO	2010/065257	A1	6/2010
WO	2010/120407	A1	10/2010
WO	2011/028589	A2	3/2011
WO	2011/028589	A3	4/2011
WO	2011/097130	A2	8/2011
WO	2011/097132	A2	8/2011
WO	2011/109336	A2	9/2011
WO	2011/097132	A3	12/2011
WO	2011/149902	A2	12/2011

OTHER PUBLICATIONS

Haule et al., "Control Scheme for Delayed Teleoperation Tasks", May 17, 1995, Proceedings of the Pacific Rim Conference on Communications, Computer and Signal Processing.

Lee et al., "A novel method of surgical instruction: International telementoring", 1998, Internet pp. 1-4.

Ogata et al., "Emotional Communication Robot: WAMOEBA-2R—Emotion Model and Evaluation Experiments", 1999, Internet, pp. 1-16.

Rovetta et al., "A New Telerobotic Application: Remote Laparoscopic Surgery Using Satellites and Optical Fiber Networks for Data Exchange", Jun. 1, 1996, International Journal of Robotics Research, pp. 267-279.

Tahboub, Karim A. et al., "Dynamics Analysis and Control of a Holonomic Vehicle With Continously Variable Transmission", Mar. 2002, Journal of Dynamic Systems, Measurement, and Control, ASME vol. 124, pp. 118-126.

Yamauchi et al., PackBot: A Versatile Platform for Military Robotics, 2004, Internet, pp. 1-10.

International Search Report received for International Patent Application No. PCT/US2007/14099, mailed on Jul. 30, 2008, 1 page.

International Preliminary Report on Patentability and Written Opinion received for International Patent Application No. PCT/US/200714099, dated Dec. 16, 2008, 5 pages.

Al-Kassab, "A Review of Telemedicine", Journal of Telemedicine and Telecare, 1999, vol. 5, Supplement 1.

F. Ando et al., "A Multimedia Self-service Terminal with Conferencing Functions", 1995, IEEE, pp. 357-362.

Android Amusement Corp., "What Marketing Secret", 1982 http:///www.theoldrobots.com/images17/dc8.JPG.

Applebome, "Planning Domesticated Robots for Tomorrow's Household", New York Times, Mar. 4, 1982, pp. 21 and 23 http://www.theoldrobots.com/images17/dc17.JPG.

(56) **References Cited**

OTHER PUBLICATIONS

Baltus et al., "Towards Personal Service Robots for the Elderly, Proceedings for the Elderly Workshop on Interactive Robots and Entertainment", 2000, Computer Science and Robotics, http://www.cs.cmu.edu/thrun/papers/thrun.nursebot-early.pdf.
Bar-Cohen et al., Virtual reality robotic telesurgery simulations using MEMICA haptic system, Mar. 5, 2001, Internet, pp. 1-7.
Bartholomew, "An Apothecary's Pharmacy", 1230-1240 http://classes.bnf.fr/ema/grands/034.htm.
Bauer, Jeffrey C., "Service Robots in Health Care: The Evolution of Mechanical Solutions to Human Resource Problems", Jun. 2003.
Bauer, John et al., "Remote telesurgical mentoring: feasibility and efficacy", 2000, IEEE, pp. 1-9.
Bischoff, "Design Concept and Realization of the Humanoid Service Robot HERMES", Field and Service Robotics, Springer, London, 1998, pp. 485-492.
Blackwell, Gerry, "Video: A Wireless LAN Killer App?", 2002, Internet pp. 1-3.
Breslow, Michael J., MD et al., "Effect of a multiple-site intensive care unit telemedicine program on clinical and economic outcome: An alternative paradigm for intensivist staffing", Critical Care Med, Jan. 2004, vol. 32, No. 1, pp. 31-38.
Brooks, Rodney, Abstracts from Flesh & Machines, How Robots Will Change Us, "Remote Presence", p. 131-147, Feb. 2002.
Candelas Herias, F.A. et al., "Flexible virtual and remote laboratory for teaching Robotics", Formatex 2006, Proc. Advance in Control Education, Madrid, Spain, Jun. 21-23, 2006.
Celi et al., "The eICU: It's not just telemedicine", Critical Care Medicine, vol. 29, No. 8 (Supplement), Aug. 2001.
Cheetham, Anastasia et al., "Interface Development for a Child's Video Conferencing Robot", 2000, pp. 1-4.
Cleary et al., "State of the art in surgical robotics: Clinical applications and technology challenges", Feb. 24, 2002 Internet, pp. 1-26.
CNN, "Floating 'droids' to roam space corridors of the future", Jan. 12, 2000, Internet, pp. 1-4.
CNN.com/Technology,"Paging R.Robot: Machine helps doctors with patients", Sep. 30, 2003, Internet, 1-3.
Crowley, "Hello to Our Future", AARP Bulletin, Jan. 2000 http://www.cs.cmu.ed/-nursebot/web/press/aarp_99_14/millennium.html.
Dalton, "Techniques for Web Telerobotics", PhD thesis, University of Western Australia, 2001, http://telerobot.mech.uwa.edu.au/information.html, http://catalogue.library.uwa.edu.au/search.
Davies, "Robotics in Minimally Invasive Surgery", 1995, Internet, pp. 5/1-5/2.
DiGiorgio, James, "Is Your Emergency Department of the 'Leading Edge'?", 2005, Internet, pp. 1-4.
Discovery Channel Canada, "Inventing the Future: 2000 Years of Discovery", Jan. 2, 2000 (Video/Transcript).
Elhajj et al., "Supermedia in Internet-based telerobotic operations", 2001, Internet, pp. 1-14.
Elhajj et al., "Synchronization and Control of Supermedia Transmission Via the Internet", Proceedings of 2001 International Symposium on Intelligent Multimedia, Video and Speech Processing, May 2-4, 2001, Hong Kong.
Ellison et al., "Telerounding and Patient Satisfaction Following Surgery".
Fels, "Developing a Video-Mediated Communication System for Hospitalized Children", Telemedicine Journal, vol. 5, No. 2, 1999.
Fetterman, Videoconferencing over the Internet, 2001, Internet, pp. 1-8.
Fiorini, "Health Care Robotics: A Progress Report, IEEE International Conference on Robotics and Automation", 1997.
Ghiasi, "A Generic Web-based Teleoperations Architecture: Details and Experience", SPIE Conference on Telemanipulator and Telepresence Technologies VI, Sep. 1999.
Goldberg et al., "Collaborative Teleoperation via the Internet", IEEE International Conference on Robotics and Automation, Apr. 2000, San Francisco, California.
Goldberg, "Desktop Teloperation via the World Wide Web, Proceedings of the IEEE International Conference on Robotics and Automation", 1995, http://citeseer.ist.psu.edu/cache/papers/cs/5/ftp:zSzzSzusc.eduzSzpubzSziriszSzraiders.pdf/gol.
Goldberg, "More Online Robots, Robots that Manipulate", Internet, Updated Aug. 2001 http://ford.ieor.berkeley.edu/ir/robots_a2.html.
Goldman, Lea, "Machine Dreams", Entrepreneurs, Forbes, May 27, 2002.
Gump, Michael D., "Robot Technology Improves VA Pharmacies", 2001, Internet, pp. 1-3.
Handley, "RFC 2327—SDP: Session Description Protocol", Apr. 1998 http://www.faqs.org/rfcs/rfc2327.html.
Hanebeck, "ROMAN: a mobile Robotic Assistant for Indoor Service Applications", Proceedings of the 1997 IEEE/RSJ International Conference on Intelligent Robots and Systems, 1997.
Harmo et al., "Moving Eye—Interactive Telepresence Over Internet With a Ball Shaped Mobile Robot", 2000.
Hees, William P., "Communications Design for a Remote Presence Robot", Jan. 14, 2002.
Holmberg, "Development of a Holonomic Mobile Robot for Mobile Manipulation Tasks", International Conference on Field and Service Robotics, Pittsburgh, PA, Aug. 1999.
Ishiguro, "Integrating a Perceptual Information Infrastructure with Robotic Avatars: A Framework for Tele-Existence" Proceeding of IEEE Conference on Intelligent Robots and Systems, http://www.ai.soc.i.kyoto-u.ac.jp/services/publications/99/99conf/07.pdf.
Ishihara, Ken et al., "Intelligent Microrobot DDS (Drug Delivery System) Measured and Controlled by Ultrasonics", Nov. 3-May 1991, IEEE/RSJ, pp. 1145-1150, vol. 2.
Itu, "ITU-T H.323 Packet-based multimedia communications", ITU, Feb. 1998, http://www.itu.int/rec/T-REC-H.323-199802-S/en.
Ivanova, Natali, "Master's thesis: Internet Based Interface for Control of a Mobile Robot", Department of Numerical Analysis and Computer Science.
Jenkins, "Telehealth Advancing Nursing Practice", Nursing Outlook, Mar./Apr. 2001, vol. 49, No. 2.
Johanson, Supporting video-mediated communication over the Internet, Chalmers University of Technology, Dept of Computer Engineering, Gothenburg, Sweden, 2003.
Jouppi, et al., "Mutually-Immersive Audio Telepresence", Audio Engineering Society Convention Paper, presented at 113^{th} Convention Oct. 2002.
Jouppi, Norman P., "First Steps Towards Mutually-Immersive Mobile Telepresence", CSCW '02, Nov. 16-20, 2002, New Orleans LA.
Kanehiro, Fumio et al., Virtual Humanoid Robot Platform to Develop Controllers of Real Humanoid Robots without Porting, 2001, IEEE, pp. 3217-3276.
Kaplan et al., "An Internet Accessible Telepresence".
Keller et al., "Raven Interface Project", Fall 2001 http://upclose.lrdc.pitt.edu/people/louw_assets/Raven_Slides.pps.
Khatib, "Robots in Human Environments", Proc. International Conference on Control, Automation, Robotics, and Vision, ICRACV2000, Dec. 2000, Singapore, pp. 454-457.
Kuzuoka et al., "Can the GestureCam Be a Surrogate?".
Lane, "Automated Aides", Newsday, Oct. 17, 2000, http://www.cs.cum.edu/-nursebot/web/press/nd4380.htm.
Lim, Hun-ok et al., Control to Realize Human-like Walking of a Biped Humanoid Robot, IEEE 2000, pp. 3271-3276.
Linebarger, John M. et al., "Concurrency Control Mechanisms for Closely Coupled Collaboration in Multithreaded Virtual Environments", Presence, Special Issue on Advances in Collaborative VEs (2004).
Loeb, Gerald, "Virtual Visit: Improving Communication for Those Who Need It Most", 2001.
Long, "HelpMate Robotics, Inc. (Formerly Transitions Research Corporation) Robot Navigation Technology", NIST Special Publication 950-1, Mar. 1999, http://www.atp.nist.gov/eao/sp950-1/helpmate.htm.
Luna, Nancy, "Robot a new face on geriatric care", OC Register, Aug. 6, 2003.
Mack, "Minimally invasive and robotic surgery", 2001, Internet IEEE, pp. 568-572.

(56) **References Cited**

OTHER PUBLICATIONS

Mair, Telepresence—The Technology and Its Economic and Social Implications, IEEE Technology and Society, 1997.
Martin, Anya, "Days Ahead", Assisted Living Today, vol. 9, Nov/Dec 2002, pp. 19-22.
Barrett, "Video Conferencing Business Soars as Companies Cut Travel; Some Travel Cuts Are Permanent", http://www.ivci.com/international_videoconferencing_news_videoconferencing_news_19.html, Mar. 13, 2002.
Brooks, "A Robust Layered Control System for a Mobile Robot," IEEE Journal of Robotics and Automation, 2 (1), Mar. 1986, 10 pgs.
Davis, "Meet iRobot, the Smartest Webcam on Wheels," Wired Magazine, 8.09, http://www.wired.com/wired/archive/8.09/irobot_pr.html, Sep. 2000, 2 pgs.
Dean, et al., "1992 AAAI Robot Exhibition and Competition," AI Magazine, Spring 1993, 10 pgs.
Defendant VGo Communications, Inc.'s Invalidity Contentions Pursuant to the Feb. 27, 2012 Civil Minute Order, May 2, 2012.
Defendant-Counterclaimant VGo Communications, Inc.'s Supplemental Invalidity Contentions Pursuant to the Feb. 27, 2012 Civil Minute Order, May 14, 2012.
Dudenhoeffer, et al., "Command and Control Architectures for Autonomous Micro-Robotic Forces", http://www.inl.gov/technicalpublications/Documents/3157051.pdf, Apr. 2001.
Elhajj, "Real-Time Haptic Feedback in Internet-Based Telerobotic Operation", IEEE International Conference on Electro/Information Technology, http://www.egr.msu.edu/~ralab-web/cgi_bin/internet-teleoperation.php, Jun. 2000.
Fong, "Collaborative Control: A Robot-Centric Model for Vehicle Teleoperation", The Robotics Institute Carnegie Mellon University, http://web.archive.org/web/20030504040803/www.ricmu.edu/cgi-bin/tech_reports.cgi?year=2001&text=0, Nov. 2001.
Goldenberg, et al., "Telemedicine in Otolaryngology", American Journal of Otolaryngology vol. 23,No. 1, 2002 , pp. 35-43.
Grow, "Office Coworker Robot," Time Magazine, http://www.time.com/time/specials/packages/article/0,28804,1936165_1936255_1936640,00.html, Nov. 19, 2001, 2 pgs.
Itu, "ITU-T H.281 A Far End Camera Control Protocol for Videoconferences using H.224", http://www.itu.int/rec/T-RECH.281-199411-I/en, Nov. 1994.
Itu, "ITU-T H.450.11 Call Intrusion Supplementary Service for H.323", http://www.itu.int/rec/T-RECH.450.11-200103-I/en, Mar. 2001.
Itu, "ITU-T H.450.9 Call Completion Supplementary Services for H.323", http://www.itu.int/rec/T-RECH.450.9-200011-I/en, Nov. 2000.
Knight, et al., "Active Visual Alignment of a Mobile Stereo Camera Platform", Proceedings of the IEEE, International Conference on Robotics and Automation, San Francisco, Apr. 24-28, 2000, pp. 3202-3208.
Metz, "HP Labs", pcmag.com, http://www.pcmag.com/article2/0,2817,1130820,00.asp, Jul. 1, 2003.
PictureTel Adds New Features and Functionality to Its Award-Winning Live200 Desktop Videoconferencing System, PR Newswire Association, LLC, Gale, Cengage Learning, http://www.thefreelibrary.com/PictureTel+Adds+New+Features+And+Functionality+To+Its+Award-Winning . . . -a019512804, Jun. 13, 1997.
Picturetel, "PictureTel Live200 for Windows NT Product Guide", http://support.polycom.com/global/documents/support/user/products/video/live200_live200NT_product_guide.pdf, Nov. 1994.
Roach, "Automatic Call Back Service in SIP", http://tools.ietf.org/pdf/draftroach-sip-acb-00.pdf, Mar. 2000.
Summers, "Microsoft NetMeeting 3 Features excerpt from Official Microsoft NetMeeting 3.0 Book", http://technet.microsoft.com/en-us/library/cc723477.aspx#XSLTsection121121120120, excerpt from Microsoft Press http://www.computerbooksonline.com/abook.asp?i=0735605823, Mar. 1999.
U.S. Appl. No. 10/783,760, filed Feb. 20, 2004, Wang, et al., 48 pgs.
U.S. Appl. No. 60/449,762, filed Feb. 24, 2003, Wang, et al., 28 pgs.
Weiss, et al., "Pebbles: A Personal Technology for Meeting Education, Social and Emotional Needs of Hospitalised Children", Personal and Ubiquitous Computing 5, Springer-Verlag London Ltd., 2001, pp. 157-168.
Zambroski, "CMU, Pitt Developing 'nursebot'", http://www.cs.cmu.edu/~nursebot/web/press/tribunereview.html, Oct. 27, 2000.
Blaer, et al., "TopBot: Automated Network Topology Detection With a Mobile Robot", Proceedings of the 2003 IEEE International Conference on Robotics 7 Automation, Taipei, Taiwan, Sep. 14-19, 2003, pp. 1582-1587.
Bradner, "The Internet Standards Process—Revision 3", Network Working Group Request for Comments: 2026, www.rfc-e ditor.org!rfC/rfc2026. txt, Oct. 1996, pp. 1-36.
Christensen et al., "BeeSoft User's Guide and Reference", Robots for the Real World™, Real World Interface, Inc., www.praecogito.com/-brudy/zaza/BeeSoft-manual-1.2-2/ beeman~1.htm, Sep. 26, 1997, pp. 1-203.
Dario, "A Robot Workstation for Diagnosis and Physical Therapy", IEEE Catalog No. 88TH0234-5, 1989, pp. 67-72.
Gump, "Robot Technology Improves VA Pharmacies", Internet, 2001, pp. 1-3.
Leifer, et al., "VIPRR: A Virtually in Person Rehabilitation Robot", Proceedings of 1997 International Conference on Rehabilitation Robotics, http://www.stanford.edu/group/rrdlPeople/vdl/publicationsIICORR97/VIPRR.html, Apr. 14-15, 1997, 4 pgs.
Minsky "Telepresence", Omni, Jun. 1980, pp. 1-6.
Motorola Technical Developments, et al., "Detection of Target Mobile Signal Strength", PriorArt Database: Technical Disclosure, IP.com, Retrieved from http:www.ip.com/pubview/IPCOM000009024D, original publication date: Jan. 1, 1999 by Motorola, Inc., pp. 205-206, Aug. 1, 2002, pp. 1583-1587.
Noritsugu, "Application of Rubber Artificial Muscle Manipulator as a Rehabilitation Robot", IEEE/ASME Transations on Mechatronics, vol. 2, No. 4, Dec. 1997, pp. 259-267.
Reynolds et al., "Review of Robotic Telemedicine Utilization in Intensive Care Units (ICUs)", 11th Annual ATA Symposium, Tampa, Florida, 2011, 1 pg.
"Saphira Software Manual", Saphira Version 5.3, ActiveMedia, Inc., 1997, 105 pgs.
Tipsuwan, et al., "Gain Adaptation of Networked Mobile Robot to Compensate QoS Deterioration", IEEE, 2000, pp. 3146-3151.
Tsui, et al., "Exploring Use Cases for Telepresence Robots", Human-Robot Interaction, Lausanne, Switzerland, http://robotics.cs.uml.edu/fileadmin/content/publications/2011/tsui-et-al-telepresence-HRI11.pdf, Robotics Lab UMass Lowell, 2011, 7 pgs.
Umass Lowell Robotics Lab, "Robotics Lab @ UMASS Lowell", Brochure, http://robotics.cs.uml.edu/fileadmin/content/brochures/roboticslab_brochure_2011_WEB.pdf, 2011, 2 pgs.
Appeal from the U.S. District Court for the Central District of California in case No. 11-cv-9185, Judge Percy Anderson, Joint Appendix, vol. I of IV, Jun. 24, 2013, pp. A1-A6357.
Appeal from the U.S. District Court for the Central District of California in case No. 11-cv-9185, Judge Percy Anderson, Joint Appendix, vol. II of IV, Jun. 24, 2013, pp. A6849-A10634.
Appeal from the U.S. District Court for the Central District of California in case No. 11-cv-9185, Judge Percy Anderson, Joint Appendix, vol. III of IV, Jun. 24, 2013, pp. A10654-A15517.
Appeal from the U.S. District Court for the Central District of California in case No. 11-cv-9185, Judge Percy Anderson, Joint Appendix, vol. IV of IV, Jun. 24, 2013, pp. A15677-A18127.
Brief for Defendant-Appellee VGO Communications, Inc., Appeal from the U.S. District Court for the Central District of California, in Case No. 2:11-cv-9185, Judge Percy Anderson, May 28, 2013, 75 pages.
Civil Minutes-General: Case No. CV 11-9185PA (AJWx), *InTouch Tech., Inc.* v. *VGo Commons, Inc.*, Sep. 10, 2012, 7 pages.
Office Action received for Chinese Patent Application No. 200680044698.0, Nov. 4, 2010, 9 pages of Official Copy and 15 pages of English Translation.
Opening Brief for Plaintiff-Appellant InTouch Technologies, Inc., Appeal from the U.S. District Court for the Central District of California in Case No. 11-cv-9185, Judge Percy Anderson, Apr. 12, 2013, 187 pages.

(56) **References Cited**

OTHER PUBLICATIONS

Reply Brief for Plaintiff-Appellant InTouch Technologies, Inc., Appeal from the U.S. District Court for the Central District of California in Case No. 11-cv-9185, Judge Percy Anderson, Jun. 14, 2013, 39 pages.
Activmedia Robotics, "Pioneer 2/PeopleBot, Operations Manual, Version 9", Oct. 2001, 78 pages.
Weaver et al., "Monitoring and Control Using the Internet and Java", vol. 3, Proceedings of the 25th Annual Conference of the IEEE Industrial Electronics Society, 1999, pp. 1152-1158.
Apple Inc., "I Phone", iPhone Series XP-002696350, pp. 1-29.
"Magne Charge", Smart Power for Electric Vehicles, General Motors Corporation, Serial No. 75189637, Registration No. 2114006, Filing Date: Oct. 29, 1996, Aug. 26, 1997, 2 pages.
"Using your Infrared Cell Phone Camera", Available on <http://www.catsdomain.com/xray/about.htm>, retrieved on Jan. 23, 2014, Courtesy of Internet Wayback Machine, Jan. 30, 2010, 4 pages.
Gostai "Gostai Jazz: Robotic Telepresence", available online at <http://www.gostai.com>, 4 pages.
Jacobs et al., "Applying Telemedicine to Outpatient Physical Therapy", AMIA, Annual Symposium Proceedings, 2002, 1 page.
Kurlowicz et al., "The Mini Mental State Examination (MMSE)", The Hartford Institute for Geriatric Nursing, Journal of Psychiatric Research, No. 3, Jan. 1999, 2 pages.
Lemaire, Edward, "Using Communication Technology to Enhance Rehabilitation Services", Terry Fox Mobile Clinic, The Rehabilitation Centre, Ottawa, Canada, Version 2.0, 1998-2001, 104 pages.
Nakazato et al., "Group-Based Interface for Content-Based Image Retrieval", Proceedings of the Working Conference on Advanced Visual Interfaces, 2002, pp. 187-194.
Nakazato et al., "Group-Oriented User Interface for Digital Image Management", Journal of Visual Languages and Computing, vol. 14, No. 4, Aug. 2003, pp. 45-46.
North, Michael, "Telemedicine: Sample Script and Specifications for a Demonstration of Simple Medical Diagnosis and Treatment Using Live Two-Way Video on a Computer Network", Greenstar Corporation, 1998, 5 pages.
Piquepaille, Roland, "How New Technologies are Modifying Our Way of Life", Roland Piquepaille's Technology Trends, This Blog and its RSS Feed Are Moving, Oct. 31, 2004, 2 pages.
Radvision, "Making Sense of Bandwidth the NetSense Way", Network Congestion in Unmanaged Networks Bandwidth Estimation and Adaptation Techniques, Radvision's Netsense Technology, 2010, 7 pages.
Roy et al., "Towards Personal Service Robots for the Elderly", Workshop on Interactive Robots and Entertainment (Wire 2000), vol. 25, Apr. 30-May 1, 2000, 7 pages.
Theodosiou et al., "MuLVAT: A Video Annotation Tool Based on XML-Dictionaries and Shot Clustering", 19th International Conference, Artificial Neural Networks-ICANN, Sep. 14-17, 2009, pp. 913-922.
Tyrrell et al., "Teleconsultation in Psychology: The Use of Videolinks for Interviewing and Assessing Elderly Patients", British Geriatrics Society, Age and Ageing, vol. 30, No. 3, May 2001, pp. 191-195.
Telepresence Research, Inc., "Telepresence Mobile Robot System", available online at <http://www. telepresence.com/telepresence-research/TELEROBOT/>, retrieved on Nov. 23, 2010, Feb. 20, 1995, 3 pages.
Adams, Chris, "Simulation of Adaptive Behavior (SAB'02)—From Animals to Animats 7", Mobile Robotics Research Group, The Seventh International Conference, available online at: <http://www.dai.ed.ac.uk/groups/mrg/MRG.html>, retrieved on Jan. 22, 2014, Aug. 4-11, 2002, 1 page.
Evans et al., "HelpMate: The Trackless Robotic Courier", PYXIS, available online at <http://www.pyxis.com/>, 3 pages.
Gaidioz et al., "Synchronizing Network Probes to Avoid Measurement Intrusiveness with the Network Weather Service", High-Performance Distributed Computing, Proceedings of the Ninth International Symposium, 2000, pp. 147-154.
Garner et al., "The Application of Telepresence in Medicine", BT Technology Journal, vol. 15, No. 4, Oct. 1, 1997, pp. 181-187.
McCardle et al., "The challenge of utilizing new technology in design education", 2000 Internet, pp. 122-127.
Meng, "E-Service Robot in Home Healthcare", Proceedings of the 2000, IEEE/RSJ, International Conference on Intelligent Robots and Systems, 2000.
Michaud, Introducing 'Nursebot', The Boston Globe, Sep. 11, 2001, pp. 1-5, http://www.cs.cmu.edu/nursebot/web/press/globe_3_01/index.html.
Mobile Robotics Research Group, "Mobile Robotics Research Group", 2000 Internet, pp. 1-2, Edinburgh.
Montemerlo, "Telepresence: Experiments in Next Generation Internet", CMU Robotics Institute, Oct. 20, 1998, http://www.ri.cmu.edu/creative/archives.htm (Video/Transcript).
Murphy, "Introduction to A1 Robotics", 2000.
Nakajima et al., "A Multimedia Teleteaching System sing an Electronic Whiteboard for Two-Way Communication of Motion Videos and Chalkboards", 1993, IEEE, pp. 436-441.
"National Energy Research Scientific Computing Center, Berkeley Lab's RAGE Telepresence Robot Captures R&D100 Award", Jul. 2, 2002, http://www.nersc.gov/news/newsroom/RAGE070202.php.
Nomadic Technologies, Inc., "Nomad XR4000 Hardware Manual", Mar. 1999.
Ogata et al., "Development of Emotional Communication Robot: WAMOEBA-2r—Esperimental evaluation . . . ", 2000 IEEE, pp. 175-180.
Oh, "Autonomous Battery Recharging for Indoor Mobile Robots", Proceedings of Australian Conference on Robotics and Automation, 2000, http://users.rsise.anu.edu.au/rsl/rsl_papers/ACRA2000/Auto_Recharge_Paper.pdf.
Ojha, Anad, "An application of Virtual Reality in Rehabilitation", Jan. 1994, IEEE, pp. 4-6.
Paulos et al., "A World Wide Web Telerobotic Remote Environment Browser", http://vive.cs.berkeley.edu/capek, 1995.
Paulos, "Designing Personal Tele-embodiment", IEEE International Conference on Robotics and Automation, 1998, http://www.prop.org/papers/icra98.pdf.
Paulos, Eric John, "Personal Tele-Embodiment", UC Berkeley, Fall 2001.
Paulos, "PRoP: Personal Roving Presence", ACM:CHI Proceedings of CHI '98, http://www.prop.org/papers/chi98.pdf.
Paulos, Video of PRoP 2 at Richmond Field Station, www.prop.org. May 2001, Printout of Home Page of Website and two-page Transcript of the audio portion of said PRoP Video.
Paulos, et al. , "Ubiquitous Tele-embodiment: Applications and Implications", International Journal of Human Computer Studies, Jun. 1997, vol. 46, No. 6, pp. 861-877.
Pin et al., "A New Family of Omnidirectional and Holonomic Wheeled Platforms for Mobile Robots", IEEE, vol. 10, No. 4, Aug. 1994.
Roy et al., "Towards Personal Service Robots for the Elderly", Internet, Mar. 7, 2002.
Salemi et al, "MILO: Personal robot platform", 2005, Internet, pp. 1-6.
Sandt, Frederic et al., "Perceptions for a Transport Robot in Public Environments", 1997, IROS '97.
Schaeffer, "Care-O-bot: A System for Assisting Elderly or Disabled Persons in Home Environments", Proceedings of AAATE-99, 1999, http://morpha.de/download/publications/IPA_Systems_For_AssistingElderly_or_DisabledPersons_AAATE1999.pdf.
Schultz, "Web Interfaces for Mobile Robots in Public Places", Robotics & Automation magazine, IEEE, vol. 7, Issue 1, Mar. 2000.
Shimoga et al., Touch and force reflection for telepresence surgery, 1994, IEEE, pp. 1049-1050.
Siegwart, "Interacting Mobile Robots on the Web", Proceedings of the 1999 IEEE International Conference on Robotics and Automation, May 1999.
Simmons, "Xavier: An Autonomous Mobile Robot on the Web", IEE robotics and Automation Magazine, 1999, pp. 43-48.

(56) **References Cited**

OTHER PUBLICATIONS

Spawar Systems Center, "Robart", 1998, San Diego, CA, http://web.archive.org/web/*/http://www.nosc.mil/robots/land/robart/robart.html http://web.archive.org/web/19981202205636/http://www.nosc.mil/robots/land/robart/robart.html.

Stephenson, Gary, "Dr. Robot Tested at Hopkins", Aug. 5, 2003, Internet, pp. 1-2.

Stoianovici et al., "Robotic Tools for Minimally Invasive Urologic Surgery", Dec. 2002, Internet, 1-17.

Suplee, "Mastering the Robot", The Washington Post, p. A01, Sep. 17, 2000 http://www.cs.cmu.edu-nursebot/web/press/wash/index.html.

Tendick et al., "Human-Machine Interfaces for Minimally Invasive Surgery", 1997, IEEE, pp. 2771-2776.

Thrun et al, "Probabilistic Algorithms and the Interactive Museum Tour-Guide Robot Minerva", 2000, Internet pp. 1-35.

Tzafestas, et al., "VR-based Teleoperation of a Mobile Robotic Assistant: Progress Report", 2000, Internet, pp. 1-23.

Urquhart, Kim, "InTouch's robotic Companion 'beams up' healthcare experts", Medical Device Daily, vol. 7, No. 39, Feb. 27, 2003, p. 1, 4.

Weiss et al., Telework and video-mediated communication: Importance of real-time, interactive communication for workers with disabilities, pp. 1-4, California State University Northridge, http://www.csun.edu/cod/conf/1999/proceedings/session0238.html.

West et al., "Design of Ball Wheel Mechanisms for Omnidirectional Vehicles with Full Mobility and Invariant Kinematics", Journal of Mechanical Design, vol. 119, pp. 153-161, Jun. 1997.

Yamasaki et al., Applying Personal Robots and Active Interface to Video Conference Systems, 1995, Internet, pp. 243-248.

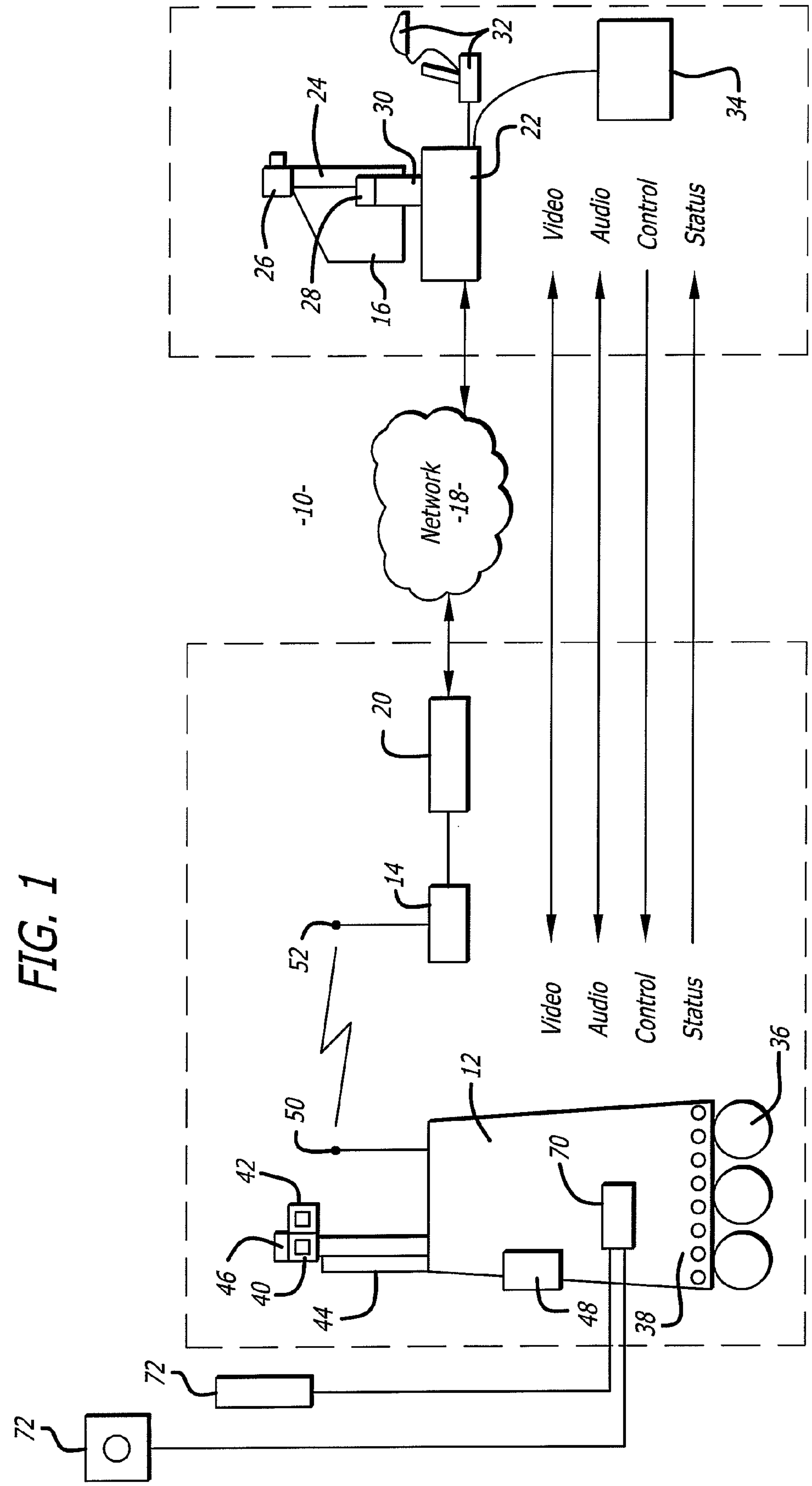
Yong et al., "Robot task execution with telepresence using virtual reality technology", 1998, Internet, pp. 1-9.

Zamrazil, Kristie, "Telemedicine in Texas: Public Policy Concerns", House Research Organization Focus Report, Texas House of Representatives, No. 76-22, May 5, 2000 http://www.hro.house.state.tx.us/focus/telemed.pdf.

Zipperer, Lorri, "Robotic dispensing system", 1999, Internet, pp. 1-2.

Zorn, Benjamin G., "Ubiquitous Telepresence", http://www.cs.colorado.edu/~zorn/ut/vision/vision.html, Mar. 5, 1996.

* cited by examiner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-18-
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Control
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Status
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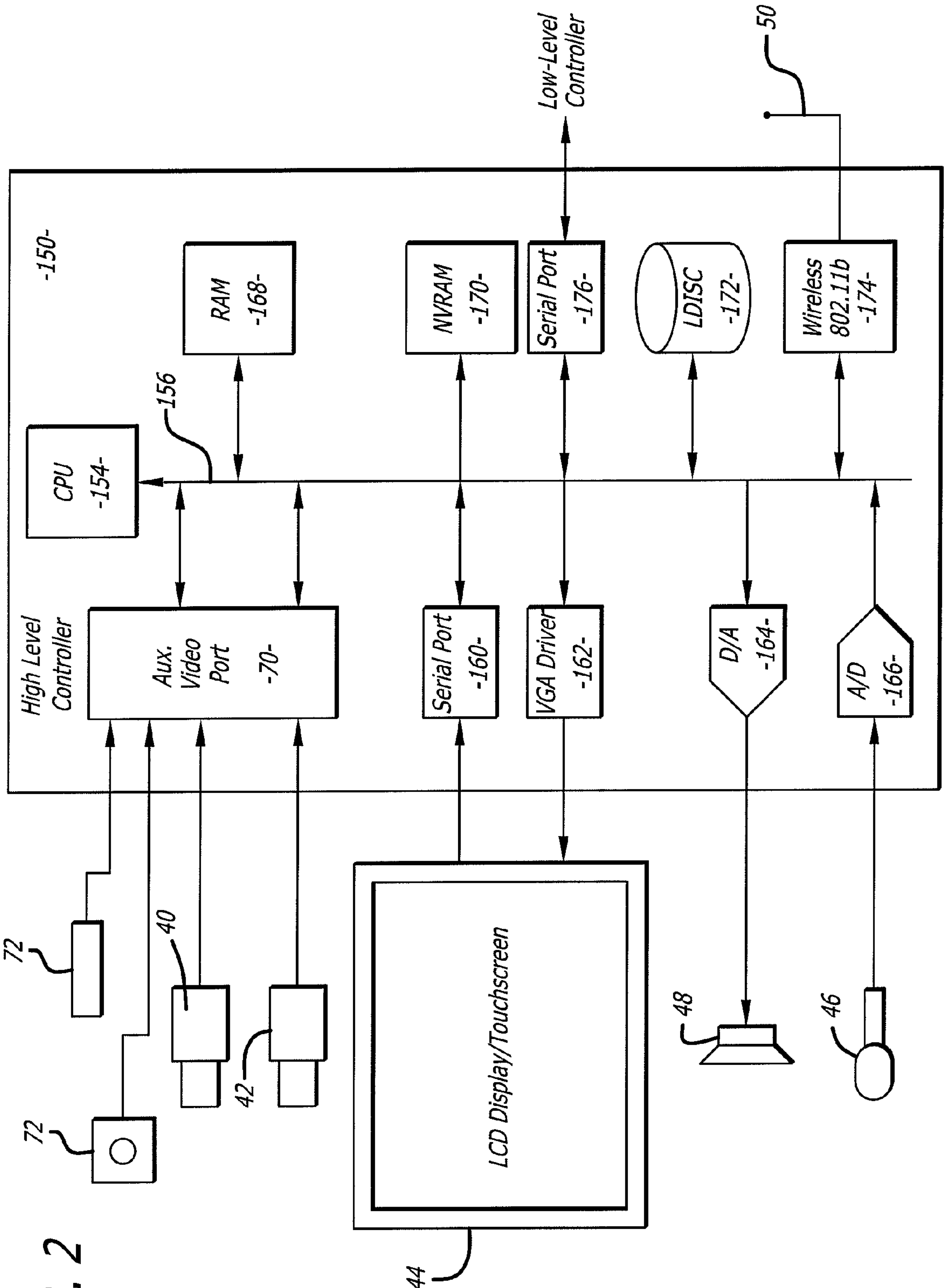
FIG. 1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50
-150-
RAM -168-
NVRAM -170-
Serial Port -176-
LDISC -172-
Wireless 802.11b -174-
156
CPU -154-
High Level Controller
Aux. Video Port -70-
Serial Port -160-
VGA Driver -162-
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40
42
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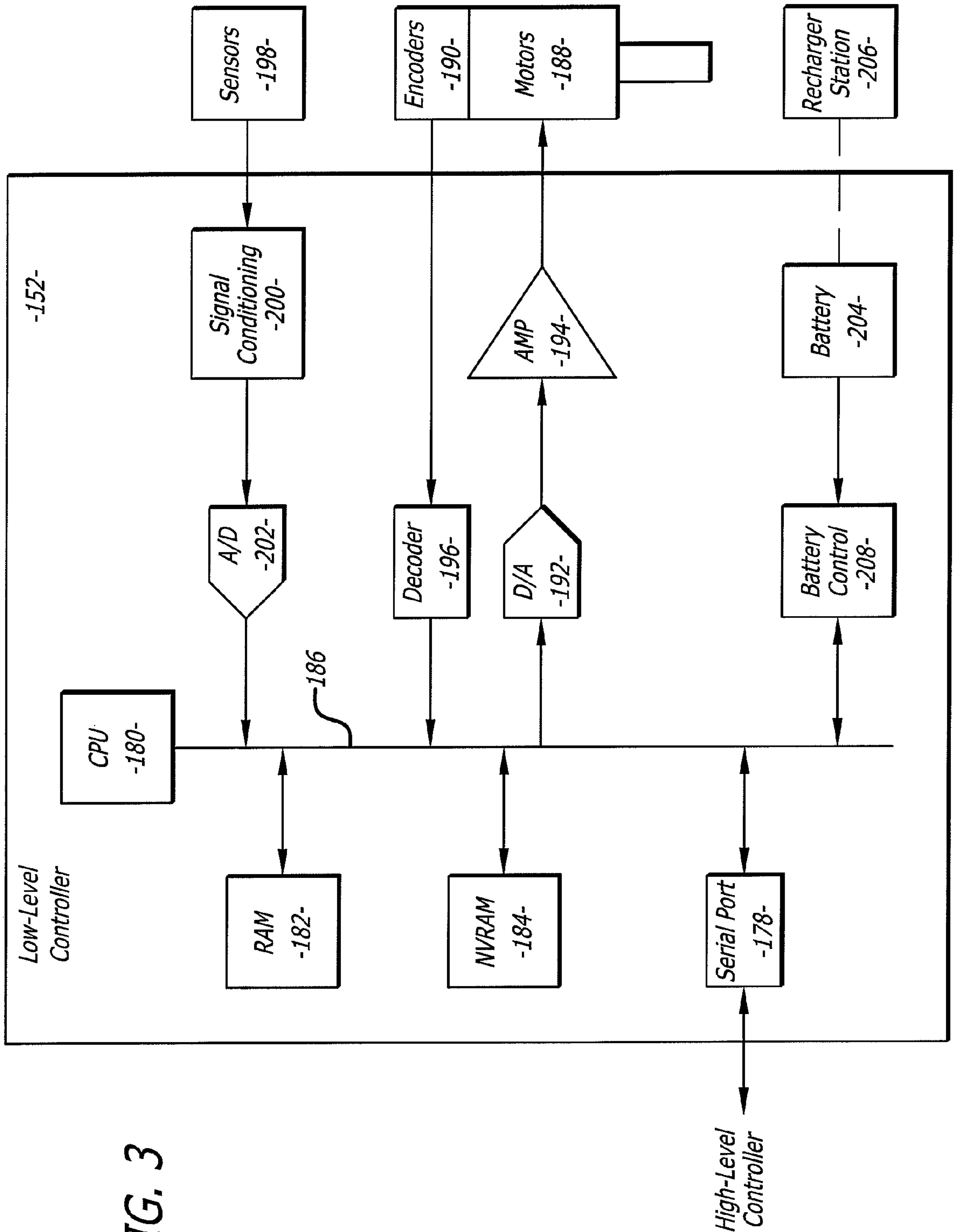
LCD Display/Touchscreen
44
48
46

FIG. 2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Encoders
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Motors
-188-
Recharger
Station
-206-
-152-
Signal
Conditioning
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Battery
-204-
A/D
-202-
Decoder
-196-
D/A
-192-
Battery
Control
-208-
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CPU
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Low-Level
Controller
RAM
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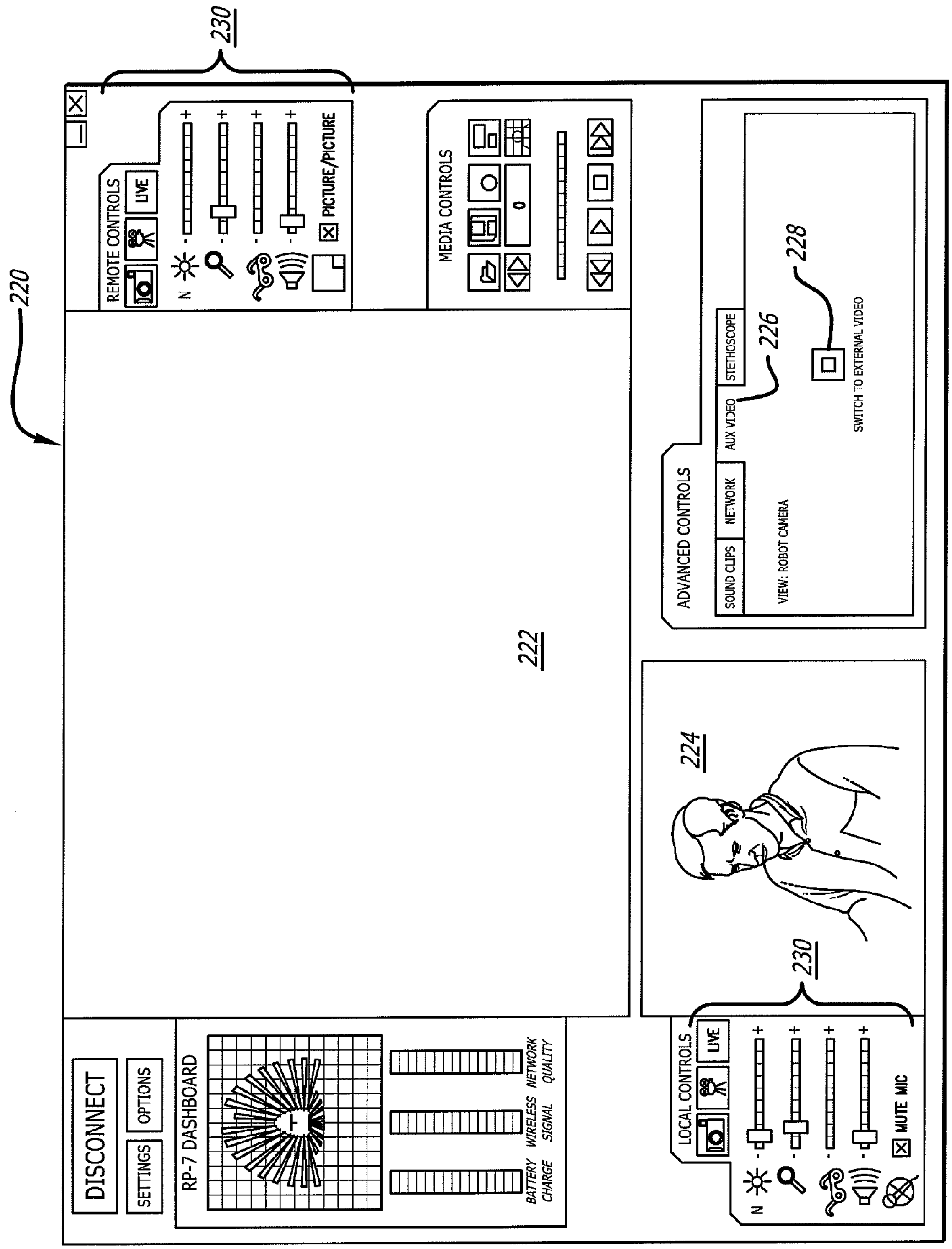
NVRAM
-184-
Serial Port
-178-
High-Level
Controller

FIG. 3


220
230
REMOTE CONTROLS
LIVE
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MEDIA CONTROLS
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ADVANCED CONTROLS
SOUND CLIPS
NETWORK
AUX VIDEO
STETHOSCOPE
226
228
VIEW: ROBOT CAMERA
SWITCH TO EXTERNAL VIDEO
222
224
230
DISCONNECT
SETTINGS
OPTIONS
RP-7 DASHBOARD
BATTERY CHARGE
WIRELESS SIGNAL
NETWORK QUALITY
LOCAL CONTROLS
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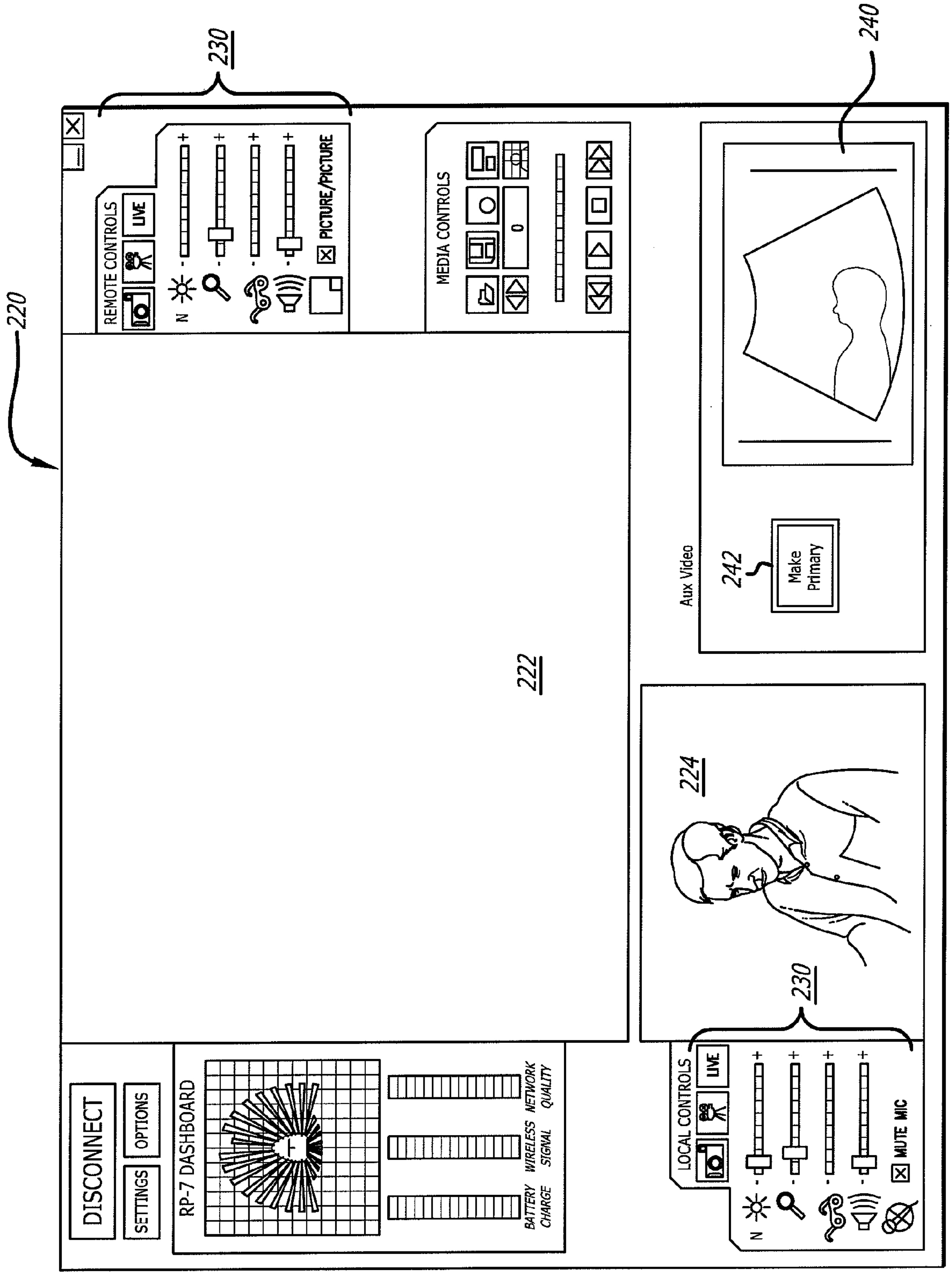
MUTE MIC

FIG. 4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REMOTE CONTROLS
LIVE
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PICTURE/PICTURE
MEDIA CONTROLS
0
240
222
Aux Video
242
Make Primary
DISCONNECT
SETTINGS
OPTIONS
RP-7 DASHBOARD
BATTERY CHARGE
WIRELESS SIGNAL
NETWORK QUALITY
224
230
LOCAL CONTROLS
LIVE
N
MUTE MIC

FIG. 5

REMOTE CONTROLLED ROBOT SYSTEM THAT PROVIDES MEDICAL IMAGES

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of U.S. application Ser. No. 11/542,605, filed on Oct. 2, 2006, pending, which is as a continuation-in-part of U.S. application Ser. No. 11/455,161, filed on Jun. 15, 2006.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The subject matter disclosed generally relates to the field of mobile two-way teleconferencing.

2. Background Information

There has been marketed a mobile robot introduced by InTouch Technologies, Inc., the assignee of this application, under the trademarks COMPANION, RP-6 and RP-7. The InTouch robot is controlled by a user at a remote station. The remote station may be a personal computer with a joystick that allows the user to remotely control the movement of the robot. Both the robot and remote station have cameras, monitors, speakers and microphones to allow for two-way video/audio communication. The robot camera provides video images to a screen at the remote station so that the user can view the robot's surroundings and move the robot accordingly.

The InTouch robot can be used by medical personnel to monitor and interact with a patient. For example, a doctor can move the robot into a patient's room and utilize the two-way videoconferencing capabilities of the system to examine the patient. Examination of the patient is limited to visual inspection and audio feedback. It would be desirable if the system would also allow other devices to be used to examine and interact with a patient.

BRIEF SUMMARY OF THE INVENTION

A remote controlled robot system that includes a mobile robot and a remote control station. The mobile robot is controlled by the remote control station and includes a robot monitor, and a robot camera that captures a robot image. The system also includes a medical image device that can be coupled to the robot. The remote control station includes a camera that captures a remote station image, and a monitor that displays the robot image captured by the robot camera in a robot view field, displays the remote station image in a station view field. The robot transmits the robot and medical images to the remote control station such that a larger portion of a network bandwidth is allocated for the medical image than the robot image.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an illustration of a robotic system;

FIG. **2** is a schematic of an electrical system of a robot;

FIG. **3** is a further schematic of the electrical system of the robot;

FIG. **4** is a graphical user interface of a remote station;

FIG. **5** is the graphical user interface showing a medical image in an auxiliary view field.

DETAILED DESCRIPTION

Disclosed is a remote controlled robot system that includes a mobile robot and a remote control station. The mobile robot is controlled by the remote control station and includes a robot monitor, and a robot camera that captures a robot image. The system also includes a medical image device that can be coupled to the robot. The remote control station includes a camera that captures a remote station image, and a monitor that displays the robot image captured by the robot camera in a robot view field, displays the remote station image in a station view field. The robot transmits the robot and medical images to the remote control station such that a larger portion of a network bandwidth is allocated for the medical image than the robot image. A medical personnel at the remote control station can interact with another personnel at the robot site to move the medical image device to vary the captured images. The system allows the remote operator to conduct a video conference with someone at the robot site while viewing medical images in real time.

Referring to the drawings more particularly by reference numbers, FIG. **1** shows a robotic system **10** that can be used to conduct a remote visit. The robotic system **10** includes a robot **12**, a base station **14** and a remote control station **16**. The remote control station **16** may be coupled to the base station **14** through a network **18**. By way of example, the network **18** may be either a packet switched network such as the Internet, or a circuit switched network such has a Public Switched Telephone Network (PSTN) or other broadband system. The base station **14** may be coupled to the network **18** by a modem **20** or other broadband network interface device. By way of example, the base station **14** may be a wireless router. Alternatively, the robot **12** may have a direct connection to the network thru for example a satellite.

The remote control station **16** may include a computer **22** that has a monitor **24**, a camera **26**, a microphone **28** and a speaker **30**. The computer **22** may also contain an input device **32** such as a joystick and/or a mouse and a keyboard **34**. The control station **16** is typically located in a place that is remote from the robot **12**. Although only one remote control station **16** is shown, the system **10** may include a plurality of remote stations. In general any number of robots **12** may be controlled by any number of remote stations **16** or other robots **12**. For example, one remote station **16** may be coupled to a plurality of robots **12**, or one robot **12** may be coupled to a plurality of remote stations **16**, or a plurality of robots **12**.

Each robot **12** includes a movement platform **36** that is attached to a robot housing **38**. Also attached to the robot housing **36** is a pair of cameras **40** and **42**, a monitor **44**, a microphone(s) **46** and a speaker(s) **48**. The microphone **46** and speaker **30** may create a stereophonic sound. The robot **12** may also have an antenna **50** that is wirelessly coupled to an antenna **52** of the base station **14**. The robot monitor **44** and cameras **40** and **82** move together in two degrees of freedom including pan and tilt directions. The system **10** allows a user at the remote control station **16** to move the robot **12** through operation of the input device **32**. The robot cameras **40** and **42** are coupled to the remote monitor **24** so that a user at the remote station **16** can view a patient. Likewise, the robot monitor **44** is coupled to the remote camera **26** so that the patient can view the user. The microphones **28** and **46**, and speakers **30** and **48**, allow for audible communication between the patient and the user.

Camera **40** may provide a wide angle view. Conversely, camera **42** may contain a zoom lens to provide a narrow angle view. Camera **42** can capture a zoom image that is transmitted to the remote control station. Camera **40** can capture a non-zoom image that can be transmitted to the remote control station. Although two cameras are shown and described, it is to be understood that the robot may contain only one camera that has the capability to provide a zoom image and a non-zoom image.

The remote station computer **22** may operate Microsoft OS software and WINDOWS XP or other operating systems such as LINUX. The remote computer **22** may also operate a video driver, a camera driver, an audio driver and a joystick driver. The video images may be transmitted and received with compression software such as MPEG CODEC.

The robot **12** may include an auxiliary video port **70**. The auxiliary video port **70** may include USB, VGA, Y-video/audio electrical connectors and associated electronic circuitry. A plurality of video devices **72** can be connected to one or more of the ports **70**. By way of example, the video devices **72** may include an ultrasound device, an otoscope, a echocardiogram, a dermatology camera, a ceiling camera and/or a video playback machine such as a VCR or DVD player. The video devices **72** capture video that is transmitted to the remote station **16** through the mobile robot **12**. By way of example, the ultrasound device may capture images of a patient that are then transmitted to the remote control station **16** and displayed by the station monitor **24**. The video devices **72** can be coupled to the robot with either a wire or through a wireless connection. For purposes of this patent an auxiliary port will describe both wireless and wired connections between a video device and the robot.

FIGS. **2** and **3** show an embodiment of a robot **12**. Each robot **12** may include a high level control system **150** and a low level control system **152**. The high level control system **150** may include a processor **154** that is connected to a bus **156**. The auxiliary video port **70** is coupled to the robot cameras **40** and **42** and the external video devices **72**. The port **70** may include a frame grabber that has multiple composite video inputs that allow the robot to capture video from the cameras **40** and **42** and the video devices **72**. The port **70** provides video from one of the video devices, or cameras **40** or **42**, based on input from the remote control station **16**. For example, the port **70** may feed video from camera **40** and then switch the feed to one of the video devices **72**.

The monitor **44** is coupled to the bus **156** by a serial output port **160** and a VGA driver **162**. The monitor **44** may include a touchscreen function that allows the patient to enter input by touching the monitor screen.

The speaker **48** is coupled to the bus **156** by a digital to analog converter **164**. The microphone **46** is coupled to the bus **156** by an analog to digital converter **166**. The high level controller **150** may also contain random access memory (RAM) device **168**, a non-volatile RAM device **170** and a mass storage device **172** that are all coupled to the bus **156**. The mass storage device **172** may contain medical files of the patient that can be accessed by the user at the remote control station **16**. For example, the mass storage device **172** may contain a picture of the patient. The user, particularly a health care provider, can recall the old picture and make a side by side comparison on the monitor **24** with a present video image of the patient provided by the camera **40**. The robot antennae **50** may be coupled to a wireless transceiver **174**. By way of example, the transceiver **174** may transmit and receive information in accordance with IEEE 802.11b.

The controller **154** may operate with a LINUX OS operating system. The controller **154** may also operate MS WINDOWS along with video, camera and audio drivers for communication with the remote control station **16**. Video information may be transceived using MPEG CODEC compression techniques. The software may allow the user to send e-mail to the patient and vice versa, or allow the patient to access the Internet. In general the high level controller **150** operates to control communication between the robot **12** and the remote control station **16**.

The remote control station **16** may include a computer that is similar to the high level controller **150**. The computer would have a processor, memory, I/O, software, firmware, etc. for generating, transmitting, receiving and processing information.

The high level controller **150** may be linked to the low level controller **152** by serial ports **176** and **178**. The low level controller **152** includes a processor **180** that is coupled to a RAM device **182** and non-volatile RAM device **184** by a bus **186**. Each robot **12** contains a plurality of motors **188** and motor encoders **190**. The motors **188** can actuate the movement platform and move other parts of the robot such as the monitor and camera. The encoders **190** provide feedback information regarding the output of the motors **188**. The motors **188** can be coupled to the bus **186** by a digital to analog converter **192** and a driver amplifier **194**. The encoders **190** can be coupled to the bus **186** by a decoder **196**. Each robot **12** also has a number of proximity sensors **198** (see also FIG. **1**). The position sensors **198** can be coupled to the bus **186** by a signal conditioning circuit **200** and an analog to digital converter **202**.

The low level controller **152** runs software routines that mechanically actuate the robot **12**. For example, the low level controller **152** provides instructions to actuate the movement platform to move the robot **12**. The low level controller **152** may receive movement instructions from the high level controller **150**. The movement instructions may be received as movement commands from the remote control station or another robot. Although two controllers are shown, it is to be understood that each robot **12** may have one controller, or more than two controllers, controlling the high and low level functions.

The various electrical devices of each robot **12** may be powered by a battery(ies) **204**. The battery **204** may be recharged by a battery recharger station **206** (see also FIG. **1**). The low level controller **152** may include a battery control circuit **208** that senses the power level of the battery **204**. The low level controller **152** can sense when the power falls below a threshold and then send a message to the high level controller **150**.

The system **10** may be the same or similar to a robotic system provided by the assignee InTouch-Health, Inc. of Santa Barbara, Calif. under the name RP-6 or RP-7. The system may also be the same or similar to the system disclosed in U.S. Pat. No. 6,925,357 issued to Wang et al. on Aug. 2, 2005, which is hereby incorporated by reference.

FIG. **4** shows a display user interface ("DUI") **220** that can be displayed at the remote station **16**. The DUI **220** may include a robot view field **222** that displays a video image provided by one of the cameras **40** or **42**, or one of the video devices **72** at the robot location. The DUI **220** may include a station view field **224** that displays a video image provided by the camera of the remote station **16**. The DUI **220** may be part of an application program stored and operated by the computer **22** of the remote station **16**.

The display user interface **220** may include a Aux Video graphical tab **226** that display a button **228**. The button **228** can be selected by a user to display video provided by one of the video devices **72** in the robot view field **222**. The interface **220** may have additional graphical icons **230** that allow the user to adjust different parameters of the system such as camera brightness, audio volume, capturing a still picture, etc.

The user can highlight a portion of a non-zoom image to display a zoom image that corresponds to the highlighted area. Additionally, the user can circle, annotate, etc. portions of video with a telestrator function of the system **10**.

The system **10** can be used in a process wherein a medical personnel such as a doctor move the robot **12** adjacent to a patient that is being assisted by another medical personnel such as a nurse. The nurse can plug the ultrasound device into the auxiliary video port of the robot. Plugging the ultrasound device into the robot may cause ultrasound images to be transmitted and displayed within the robot view field **222**. Alternatively, the doctor can select graphical button **228** which causes the ultrasound image to be displayed in an auxiliary view field **240** shown in FIG. **5**. The auxiliary field **240** may have a graphical button **242** that can be selected to switch the ultrasound image into the robot view field **222** and the images from the robot camera into field **240**. When both ultrasound and video images from the robot camera are transmitted to the remote station, the robot may enter a mode wherein the ultrasound images are transmitted at a larger frame size, higher frame rate and higher video compression and the robot camera images are transmitted at a smaller frame size, lower frame rate and lower compression. This mode allocates a higher portion of network bandwidth to the medical images. This mode can be selected through a graphical button (not shown) displayed on the remote control station monitor. The robot camera images and the medical images may also be encrypted. For example, the images may be encrypted with a 128 bit AES encryption with a symmetric key that is exchanged at the start of a session.

During a session where an ultrasound device is coupled to the robot a technician may be located at the robot site in the vicinity of a patient. The technician may move the ultrasound device to different positions on the patient. The images are transmitted to the control station and displayed by the monitor for viewing by a doctor. The doctor and technician can discuss the ultrasound images through the control station and robot. The doctor may also provide instructions on where to place the ultrasound device. For example, the doctor can instruct the technician to move the ultrasound device to different locations on a patient. The system allows the doctor to conduct a remote video conference while viewing ultrasound images in real time.

The robot **12** may be placed in a home or a facility where one or more patients are to be monitored and/or assisted. The facility may be a hospital or a residential care facility. By way of example, the robot **12** may be placed in a home where a health care provider may monitor and/or assist the patient. Likewise, a friend or family member may communicate with the patient. The cameras and monitors at both the robot and remote control stations allow for teleconferencing between the patient and the person at the remote station(s).

The robot **12** can be maneuvered through the home or a facility by manipulating the input device **32** at a remote station **16**. The robot **10** may be controlled by a number of different users. To accommodate for this the robot may have an arbitration system. The arbitration system may be integrated into the operating system of the robot **12**. For example, the arbitration technique may be embedded into the operating system of the high-level controller **150**.

By way of example, the users may be divided into classes that include the robot itself, a local user, a caregiver, a doctor, a family member, or a service provider. The robot **12** may override input commands that conflict with robot operation. For example, if the robot runs into a wall, the system may ignore all additional commands to continue in the direction of the wall. A local user is a person who is physically present with the robot. The robot could have an input device that allows local operation. For example, the robot may incorporate a voice recognition system that receives and interprets audible commands.

A caregiver is someone who remotely monitors the patient. A doctor is a medical professional who can remotely control the robot and also access medical files contained in the robot memory. The family and service users remotely access the robot. The service user may service the system such as by upgrading software, or setting operational parameters.

The robot **12** may operate in one of two different modes; an exclusive mode, or a sharing mode. In the exclusive mode only one user has access control of the robot. The exclusive mode may have a priority assigned to each type of user. By way of example, the priority may be in order of local, doctor, caregiver, family and then service user. In the sharing mode two or more users may share access with the robot. For example, a caregiver may have access to the robot, the caregiver may then enter the sharing mode to allow a doctor to also access the robot. Both the caregiver and the doctor can conduct a simultaneous tele-conference with the patient.

The arbitration scheme may have one of four mechanisms; notification, timeouts, queue and call back. The notification mechanism may inform either a present user or a requesting user that another user has, or wants, access to the robot. The timeout mechanism gives certain types of users a prescribed amount of time to finish access to the robot. The queue mechanism is an orderly waiting list for access to the robot. The call back mechanism informs a user that the robot can be accessed. By way of example, a family user may receive an e-mail message that the robot is free for usage. Tables I and II, show how the mechanisms resolve access request from the various users.

TABLE I

User	Access Control	Medical Record	Command Override	Software/Debug Access	Set Priority
Robot	No	No	Yes (1)	No	No
Local	No	No	Yes (2)	No	No
Caregiver	Yes	Yes	Yes (3)	No	No
Doctor	No	Yes	No	No	No
Family	No	No	No	No	No
Service	Yes	No	Yes	Yes	Yes

TABLE II

		Requesting User				
		Local	Caregiver	Doctor	Family	Service
Current User	Local	Not Allowed	Warn current user of pending user Notify requesting user that system is in use Set timeout	Warn current user of pending user Notify requesting user that system is in use Set timeout = 5 m	Warn current user of pending user Notify requesting user that system is in use Set timeout = 5 m Call back	Warn current user of pending user Notify requesting user that system is in use No timeout Call back

TABLE II-continued

	Requesting User				
	Local	Caregiver	Doctor	Family	Service
Caregiver	Warn current user of pending user. Notify requesting user that system is in use. Release control	Not Allowed	Warn current user of pending user Notify requesting user that system is in use Set timeout = 5 m Queue or callback	Warn current user of pending user Notify requesting user that system is in use Set timeout = 5 m	Warn current user of pending user Notify requesting user that system is in use No timeout Callback
Doctor	Warn current user of pending user Notify requesting user that system is in use Release control	Warn current user of pending user Notify requesting user that system is in use Set timeout = 5 m	Warn current user of pending user Notify requesting user that system is in use No timeout Callback	Notify requesting user that system is in use No timeout Queue or callback	Warn current user of pending user Notify requesting user that system is in use No timeout Callback
Family	Warn current user of pending user Notify requesting user that system is in use Release Control	Notify requesting user that system is in use No timeout Put in queue or callback	Warn current user of pending user Notify requesting user that system is in use Set timeout = 1 m	Warn current user of pending user Notify requesting user that system is in use Set timeout = 5 m Queue or callback	Warn current user of pending user Notify requesting user that system is in use No timeout Callback
Service	Warn current user of pending user Notify requesting user that system is in use No timeout	Notify requesting user that system is in use No timeout Callback	Warn current user of request Notify requesting user that system is in use No timeout Callback	Warn current user of pending user Notify requesting user that system is in use No timeout Queue or callback	Not Allowed

The information transmitted between the station **16** and the robot **12** may be encrypted. Additionally, the user may have to enter a password to enter the system **10**. A selected robot is then given an electronic key by the station **16**. The robot **12** validates the key and returns another key to the station **16**. The keys are used to encrypt information transmitted in the session.

The robot **12** and remote station **16** transmit commands through the broadband network **18**. The commands can be generated by the user in a variety of ways. For example, commands to move the robot may be generated by moving the joystick **32** (see FIG. **1**). The commands are preferably assembled into packets in accordance with TCP/IP protocol. Table III provides a list of control commands that are generated at the remote station and transmitted to the robot through the network.

TABLE III

Control Commands		
Command	Example	Description
drive	drive 10.0 0.0 5.0	The drive command directs the robot to move at the specified velocity (in cm/sec) in the (x, y) plane, and turn its facing at the specified rate (degrees/sec).
goodbye	goodbye	The goodbye command terminates a user session and relinquishes control of the robot
gotoHomePosition	gotoHomePosition 1	The gotoHomePosition command moves the head to a fixed “home” position (pan and tilt), and restores zoom to default value. The index value can be 0, 1, or 2. The exact pan/tilt values for each index are specified in robot configuration files.
head	head vel pan 5.0 tilt 10.0	The head command controls the head motion. It can send commands in two modes, identified by keyword: either positional (“pos”) or velocity (“vol”). In velocity mode, the pan and tilt values are desired velocities of the head on the pan and tilt axes, in degree/sec. A single command can include just the pan section, or just the tilt section, or both.
keepalive	keepalive	The keepalive command causes no action, but keeps the communication (socket) link open so that a session can continue. In scripts, it can be used to introduce delay time into the action.

TABLE III-continued

Control Commands		
Command	Example	Description
odometry	odometry 5	The odometry command enables the flow of odometry messages from the robot. The argument is the number of times odometry is to be reported each second. A value of 0 turns odometry off.
reboot	reboot	The reboot command causes the robot computer to reboot immediately. The ongoing session is immediately broken off.
restoreHeadPosition	restoreHeadPosition	The restoreHeadPosition functions like the gotoHomePosition command, but it homes the head to a position previously saved with gotoHomePosition.
saveHeadPosition	saveHeadPosition	The saveHeadPosition command causes the robot to save the current head position (pan and tilt) in a scratch location in temporary storage so that this position can be restored. Subsequent calls to "restoreHeadPosition" will restore this saved position. Each call to saveHeadPosition overwrites any previously saved position.
setCameraFocus	setCameraFocus 100.0	The setCameraFocus command controls focus for the camera on the robot side. The value sent is passed "raw" to the video application running on the robot, which interprets it according to its own specification.
setCameraZoom	setCameraZoom 100.0	The setCameraZoom command controls zoom for the camera on the robot side. The value sent is passed "raw" to the video application running on the robot, which interprets it according to its own specification.
shutdown	Shutdown	The shutdown command shuts down the robot and powers down its computer.
stop	stop	The stop command directs the robot to stop moving immediately. It is assumed this will be as sudden a stop as the mechanism can safely accommodate.
timing	Timing 3245629 500	The timing message is used to estimate message latency. It holds the UCT value (seconds + milliseconds) of the time the message was sent, as recorded on the sending machine. To do a valid test, you must compare results in each direction (i.e., sending from machine A to machine B, then from machine B to machine A) in order to account for differences in the clocks between the two machines. The robot records data internally to estimate average and maximum latency over the course of a session, which it prints to log files.
userTask	userTask "Jane Doe" "Remote Visit"	The userTask command notifies the robot of The current user and task. It typically is sent once at the start of the session, although it can be sent during a session if the user and/or task change. The robot uses this information for record-keeping.

Table IV provides a list of reporting commands that are generated by the robot and transmitted to the remote station through the network.

TABLE IV

Reporting Commands		
Command	Example	Description
abnormalExit	abnormalExit	This message informs the user that the robot software has crashed or otherwise exited abnormally. Te robot software catches top-level exceptions and generates this message if any such exceptions occur.

TABLE IV-continued

Reporting Commands		
Command	Example	Description
bodyType	bodyType 3	The bodyType message informs the station which type body (using the numbering of the mechanical team) the current robot has. This allows the robot to be drawn correctly in the station user interface, and allows for any other necessary body-specific adjustments.
driveEnabled	driveEnabled true	This message is sent at the start of a session to indicate whether the drive system is operational.
emergencyShutdown	emergencyShutdown	This message informs the station that the robot software has detected a possible "runaway" condition (an failure causing the robot to move out of control) and is shutting the entire system down to prevent hazardous motion.
odometry	odometry 10 20 340	The odometry command reports the current (x, y) position (cm) and body orientation (degrees) of the robot, in the original coordinate space of the robot at the start of the session.
sensorGroup	group_data	Sensors on the robot are arranged into groups, each group of a single type (bumps, range sensors, charge meter, etc.) The sensorGroup message is sent once per group at the start of each session. It contains the number, type, locations, and any other relevant data for the sensors in that group. The station assumes nothing about the equipment carried on the robot; everything it knows about the sensors comes from the sensorGroup messages.
sensorState	groupName state data	The sensorState command reports the current state values for a specified group of sensor. The syntax and interpretation for the state data is specific to each group. This message is sent once for each group at each sensor evaluation (normally several times per second).
systemError	systemError driveController	This message informs the station user of a failure in one of the robot's subsystems. The error_type argument indicates which subsystem failed, including driveController, sensorController, headHome.
systemInfo	systemInfo wireless 45	This message allows regular reporting of information that falls outside the sensor system such as wireless signal strength.
text	text "This is some text"	The text string sends a text string from the robot to the station, where the string is displayed to the user. This message is used mainly for debugging.
version	version 1.6	This message identifies the software version currently running on the robot. It is sent once at the start of the session to allow the station to do any necessary backward compatibility adjustments.

The processor **154** of the robot high level controller **150** may operate a program that determines whether the robot **12** has received a robot control command within a time interval. For example, if the robot **12** does not receive a control command within 2 seconds then the processor **154** provides instructions to the low level controller **150** to stop the robot **12**. Although a software embodiment is described, it is to be understood that the control command monitoring feature could be implemented with hardware, or a combination of hardware and software. The hardware may include a timer that is reset each time a control command is received and generates, or terminates, a command or signal, to stop the robot.

The remote station computer **22** may monitor the receipt of video images provided by the robot camera. The computer **22** may generate and transmit a STOP command to the robot if the remote station does not receive or transmit an updated video image within a time interval. The STOP command causes the robot to stop. By way of example, the computer **22** may generate a STOP command if the remote control station does not receive a new video image within 2 seconds. Although a software embodiment is described, it is to be understood that the video image monitoring feature could be implemented with hardware, or a combination of hardware and software. The hardware may include a timer that is reset each time a new video image is received and generates, or terminates, a command or signal, to generate the robot STOP command.

While certain exemplary embodiments have been described and shown in the accompanying drawings, it is to be understood that such embodiments are merely illustrative of and not restrictive on the broad invention, and that this invention not be limited to the specific constructions and arrangements shown and described, since various other modifications may occur to those ordinarily skilled in the art.

What is claimed is:

1. A remote controlled robot system, comprising:

a robot with a robot monitor, and a robot camera that captures a patient image of a patient, said robot having an auxiliary video port, said robot including a microphone and a speaker;

a medical image device that is coupled to said auxiliary video port and can capture a medical image of a patient; and,

a remote control station that has a microphone and a speaker and transmits commands to control said robot, said remote control station includes a control station camera that captures a medical image of a medical personnel and a control station monitor that displays a display user interface, said display user interface simultaneously displays the patient image captured by said robot camera in a robot view field, said medical personnel image in a station view field, and said medical image in an auxiliary view field, wherein a doctor located at said remote control station can conduct a video conference with a technician located at said robot while viewing the patient image and the medical image.

2. The system of claim **1**, wherein said medical image device is an ultrasound device.

3. The system of claim **1**, wherein said medical image device is an otoscope.

4. The system of claim **1**, wherein said medical image device is an echocardiogram.

5. The system of claim **1**, further comprising a broadband network coupled to said robot and said remote control station.

6. The system of claim **1**, wherein said robot camera and said robot monitor are mechanically coupled to always move together.

7. The system of claim **1**, wherein a larger portion of a network bandwidth is allocated for the medical image than the patient image.

8. A method for reviewing images of a patient, comprising:

moving a robot that has a microphone, a speaker, a monitor and a camera adjacent to a patient with commands from a remote control station that includes a microphone, a speaker, a camera and a monitor;

capturing a patient image of a patient with the robot camera;

transmitting the patient image to the remote control station;

displaying the patient image on the remote control station monitor;

moving a medical image device relative to a patient by a technician;

capturing a medical personnel image of the patient with the medical image device, the captured medical image being provided to the robot;

transmitting the medical image from the robot to the remote control station;

capturing a medical personnel image of a medical personnel with a remote control station camera;

displaying the medical image on a display user interface of the remote control station monitor simultaneously with the display of the patient image and the remote station medical personnel image; and, conducting a video conference between the technician and a doctor, while the doctor views the medical image and the patient image.

9. The method of claim **8**, wherein the medical image device captures ultrasound images.

10. The method of claim **8**, further comprising selecting a graphical input of a graphical user interface displayed by the remote control station monitor to display the medical image.

11. The method of claim **8**, wherein the medical image is transmitted at a higher frame rate than the patient image.

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