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(54) **SYSTEM AND METHOD FOR PROVIDING A NATURAL LANGUAGE CONTENT DEDICATION SERVICE**

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(58) **Field of Classification Search**
None
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,430,669	A	2/1984	Cheung	358/122
5,027,406	A	6/1991	Roberts et al.	381/43
5,155,743	A	10/1992	Jacobs	375/28
5,208,748	A	5/1993	Flores et al.	364/419
5,274,560	A	12/1993	LaRue	364/444
5,357,596	A	10/1994	Takebayashi et al.	395/2.84
5,377,350	A	12/1994	Skinner	395/600
5,386,556	A	1/1995	Hedin et al.	395/600
5,424,947	A	6/1995	Nagao et al.	364/419.08
5,471,318	A	11/1995	Ahuja et al.	358/400

(Continued)

FOREIGN PATENT DOCUMENTS

EP	1 320 043 A2	6/2003
EP	1 646 037	4/2006

(Continued)

OTHER PUBLICATIONS

Reuters, "IBM to Enable Honda Drivers to Talk to Cars", Charles Schwab & Co., Inc., Jul. 28, 2002, 1 page.

(Continued)

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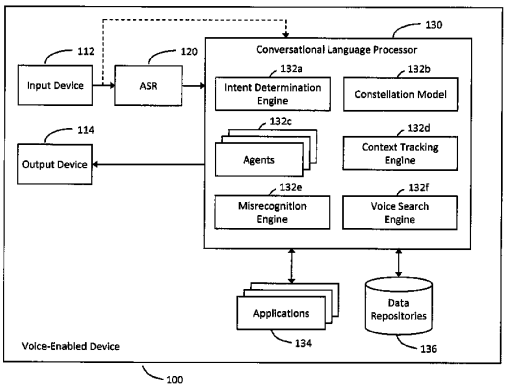
(57) **ABSTRACT**

The system and method described herein may provide a natural language content dedication service in a voice services environment. In particular, providing the natural language content dedication service may generally include detecting multi-modal device interactions that include requests to dedicate content, identifying the content requested for dedication from natural language utterances included in the multi-modal device interactions, processing transactions for the content requested for dedication, processing natural language to customize the content for recipients of the dedications, and delivering the customized content to the recipients of the dedications.

19 Claims, 8 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

5,475,733	A	12/1995	Eisdorfer et al.	379/52
5,488,652	A	1/1996	Bielby et al.	379/88
5,499,289	A	3/1996	Bruno et al.	379/220
5,500,920	A	3/1996	Kupiec	395/2.79
5,517,560	A	5/1996	Greenspan	379/114
5,533,108	A	7/1996	Harris et al.	379/201
5,537,436	A	7/1996	Bottoms et al.	375/222
5,539,744	A	7/1996	Chu et al.	370/60
5,557,667	A	9/1996	Bruno et al.	379/201
5,563,937	A	10/1996	Bruno et al.	379/201
5,577,165	A	11/1996	Takebayashi et al.	395/2.84
5,590,039	A	12/1996	Ikeda et al.	395/759
5,608,635	A	3/1997	Tamai	364/449.3
5,617,407	A	4/1997	Bareis	369/275.3
5,633,922	A	5/1997	August et al.	379/220
5,675,629	A	10/1997	Raffel et al.	379/58
5,696,965	A	12/1997	Dedrick	395/610
5,708,422	A	1/1998	Blonder et al.	340/825.34
5,721,938	A	2/1998	Stuckey	395/754
5,722,084	A	2/1998	Chakrin et al.	455/551
5,740,256	A	4/1998	Castello Da Costa et al.	361/94.7
5,742,763	A	4/1998	Jones	395/200.3
5,748,841	A	5/1998	Morin et al.	395/2.66
5,748,974	A	5/1998	Johnson	395/759
5,752,052	A	5/1998	Richardson et al.	395/759
5,754,784	A	5/1998	Garland et al.	395/200.49
5,761,631	A	6/1998	Nasukawa	704/9
5,774,859	A	6/1998	Houser et al.	704/275
5,794,050	A	8/1998	Dahlgren et al.	395/708
5,794,196	A	8/1998	Yegnanarayanan et al.	704/255
5,797,112	A	8/1998	Komatsu et al.	701/201
5,799,276	A	8/1998	Komissarchik et al.	704/251
5,802,510	A	9/1998	Jones	707/2
5,832,221	A	11/1998	Jones	375/200.36
5,839,107	A	11/1998	Gupta et al.	704/270
5,848,396	A	12/1998	Gerace	705/10
5,855,000	A	12/1998	Waibel et al.	704/235
5,867,817	A	2/1999	Catallo et al.	704/255
5,878,385	A	3/1999	Bralich et al.	704/9
5,878,386	A	3/1999	Coughlin	704/10
5,892,813	A	4/1999	Morin et al.	379/88.01
5,892,900	A *	4/1999	Ginter et al.	726/26
5,895,464	A	4/1999	Bhandari et al.	707/3
5,895,466	A	4/1999	Goldberg et al.	707/5
5,897,613	A	4/1999	Chan	704/210
5,902,347	A	5/1999	Backman et al.	701/200
5,911,120	A	6/1999	Jarett et al.	455/417
5,918,222	A	6/1999	Fukui et al.	707/1
5,926,784	A	7/1999	Richardson et al.	704/9
5,933,822	A	8/1999	Braden-Harder et al.	707/5
5,953,393	A	9/1999	Culbreth et al.	379/88.25
5,960,397	A	9/1999	Rahim	704/244
5,960,399	A	9/1999	Barclay et al.	704/270
5,960,447	A	9/1999	Holt et al.	707/500
5,963,894	A	10/1999	Richardson et al.	704/9
5,963,940	A	10/1999	Liddy et al.	707/5
5,987,404	A	11/1999	Della Pietra et al.	704/9
5,991,721	A	11/1999	Asano et al.	704/257
5,995,119	A	11/1999	Cosatto et al.	345/473
5,995,928	A	11/1999	Nguyen et al.	704/251
6,009,382	A	12/1999	Martino et al.	704/1
6,014,559	A	1/2000	Amin	455/413
6,018,708	A	1/2000	Dahan et al.	704/244
6,021,384	A	2/2000	Gorin et al.	704/1
6,035,267	A	3/2000	Watanabe et al.	704/1
6,044,347	A	3/2000	Abella et al.	704/272
6,049,602	A	4/2000	Foladare et al.	379/265
6,049,607	A	4/2000	Marash et al.	379/410
6,058,187	A	5/2000	Chen	380/21
6,067,513	A	5/2000	Ishimitsu	704/233
6,076,059	A	6/2000	Glickman et al.	704/260
6,078,886	A	6/2000	Dragosh et al.	704/270
6,081,774	A	6/2000	De Hita et al.	704/9
6,085,186	A	7/2000	Christianson et al.	707/3
6,101,241	A	8/2000	Boyce et al.	379/88.01
6,108,631	A	8/2000	Ruhl	704/270
6,119,087	A	9/2000	Kuhn et al.	704/270
6,122,613	A	9/2000	Baker	704/235
6,134,235	A	10/2000	Goldman et al.	370/352
6,144,667	A	11/2000	Doshi et al.	370/401
6,144,938	A	11/2000	Surace et al.	704/257
6,154,526	A	11/2000	Dahlke et al.	379/88.03
6,160,883	A	12/2000	Jackson et al.	379/230
6,167,377	A	12/2000	Gillick et al.	704/240
6,173,266	B1	1/2001	Marx et al.	704/270
6,173,279	B1	1/2001	Levin et al.	707/5
6,175,858	B1	1/2001	Bulfer et al.	709/206
6,185,535	B1	2/2001	Hedin et al.	704/270
6,188,982	B1	2/2001	Chiang	704/256
6,192,110	B1	2/2001	Abella et al.	379/88.01
6,192,338	B1	2/2001	Haszto et al.	704/257
6,195,634	B1	2/2001	Dudemaine et al.	704/231
6,195,651	B1	2/2001	Handel et al.	707/2
6,199,043	B1	3/2001	Happ	704/272
6,208,964	B1	3/2001	Sabourin	704/244
6,208,972	B1	3/2001	Grant et al.	704/275
6,219,346	B1	4/2001	Maxemchuk	370/338
6,219,643	B1	4/2001	Cohen et al.	704/257
6,226,612	B1	5/2001	Srenger et al.	704/256
6,233,556	B1	5/2001	Teunen et al.	704/250
6,233,559	B1	5/2001	Balakrishnan	704/275
6,233,561	B1	5/2001	Junqua et al.	704/277
6,236,968	B1	5/2001	Kanevsky et al.	704/275
6,246,981	B1	6/2001	Papineni et al.	704/235
6,246,990	B1	6/2001	Happ	704/275
6,266,636	B1	7/2001	Kosaka et al.	704/244
6,269,336	B1	7/2001	Ladd et al.	704/270
6,272,455	B1	8/2001	Hoshen et al.	704/1
6,275,231	B1	8/2001	Obradovich	345/349
6,278,968	B1	8/2001	Franz et al.	704/3
6,288,319	B1	9/2001	Catona	84/609
6,292,767	B1	9/2001	Jackson et al.	704/1
6,301,560	B1	10/2001	Masters	704/251
6,308,151	B1	10/2001	Smith	704/235
6,314,402	B1	11/2001	Monaco et al.	704/275
6,356,869	B1	3/2002	Chapados et al.	704/275
6,362,748	B1	3/2002	Huang	340/901
6,366,882	B1	4/2002	Bijl et al.	704/235
6,366,886	B1	4/2002	Dragosh et al.	704/270.1
6,374,214	B1	4/2002	Friedland et al.	704/235
6,377,913	B1	4/2002	Coffman et al.	704/8
6,381,535	B1	4/2002	Durocher et al.	701/202
6,385,596	B1	5/2002	Wiser et al.	705/51
6,385,646	B1	5/2002	Brown et al.	709/217
6,393,403	B1	5/2002	Majaniemi	704/275
6,393,428	B1	5/2002	Miller et al.	707/102
6,397,181	B1	5/2002	Li et al.	704/256
6,404,878	B1	6/2002	Jackson et al.	379/221.01
6,405,170	B1	6/2002	Phillips et al.	704/270
6,408,272	B1	6/2002	White et al.	704/270.1
6,411,810	B1	6/2002	Maxemchuk	455/453
6,415,257	B1	7/2002	Junqua et al.	704/275
6,418,210	B1	7/2002	Sayko	379/142.15
6,420,975	B1	7/2002	DeLine et al.	340/815.4
6,429,813	B2	8/2002	Feigen	342/357.13
6,430,285	B1	8/2002	Bauer et al.	379/265.01
6,430,531	B1	8/2002	Polish	704/257
6,434,523	B1	8/2002	Monaco	704/257
6,434,524	B1	8/2002	Weber	704/257
6,434,529	B1	8/2002	Walker et al.	704/275
6,442,522	B1	8/2002	Carberry et al.	704/257
6,446,114	B1	9/2002	Bulfer et al.	709/206
6,453,153	B1	9/2002	Bowker et al.	455/67.4
6,453,292	B2	9/2002	Ramaswamy et al.	704/235
6,456,711	B1	9/2002	Cheung et al.	379/265.09
6,456,974	B1	9/2002	Baker et al.	704/270.1
6,466,654	B1	10/2002	Cooper et al.	379/88.01
6,466,899	B1	10/2002	Yano et al.	704/1
6,470,315	B1	10/2002	Netsch et al.	704/256
6,498,797	B1	12/2002	Anerousis et al.	370/522
6,499,013	B1	12/2002	Weber	704/257
6,501,833	B2	12/2002	Phillips et al.	379/88.07
6,501,834	B1	12/2002	Milewski et al.	379/93.24

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,505,155	B1	1/2003	Vanbuskirk et al.	704/246
6,510,417	B1	1/2003	Woods et al.	704/275
6,513,006	B2	1/2003	Howard et al.	704/257
6,522,746	B1	2/2003	Marchok et al.	379/406.03
6,523,061	B1	2/2003	Halverson et al.	709/202
6,532,444	B1	3/2003	Weber	704/257
6,539,348	B1	3/2003	Bond et al.	704/9
6,549,629	B2	4/2003	Finn et al.	381/92
6,553,372	B1	4/2003	Brassell et al.	707/5
6,556,970	B1	4/2003	Sasaki et al.	704/257
6,556,973	B1	4/2003	Lewin	704/277
6,560,576	B1	5/2003	Cohen et al.	704/270
6,560,590	B1	5/2003	Shwe et al.	706/55
6,567,778	B1	5/2003	Chao Chang et al.	704/257
6,567,797	B1	5/2003	Schuetze et al.	707/2
6,570,555	B1	5/2003	Prevost et al.	345/156
6,570,964	B1	5/2003	Murveit et al.	379/67.1
6,571,279	B1	5/2003	Herz et al.	709/217
6,574,597	B1	6/2003	Mohri et al.	704/251
6,574,624	B1	6/2003	Johnson et al.	707/5
6,578,022	B1	6/2003	Foulger et al.	706/45
6,581,103	B1	6/2003	Dengler	709/231
6,584,439	B1	6/2003	Geilhufe et al.	704/270
6,587,858	B1	7/2003	Strazza	707/102
6,591,239	B1	7/2003	McCall et al.	704/275
6,594,257	B1	7/2003	Doshi et al.	370/352
6,594,367	B1	7/2003	Marash et al.	381/92
6,598,018	B1	7/2003	Junqua	704/251
6,601,026	B2	7/2003	Appelt et al.	704/9
6,604,075	B1	8/2003	Brown et al.	704/270.1
6,604,077	B2	8/2003	Dragosh et al.	704/270.1
6,606,598	B1	8/2003	Holthouse et al.	704/275
6,611,692	B2	8/2003	Raffel et al.	455/552
6,614,773	B1	9/2003	Maxemchuk	370/337
6,615,172	B1	9/2003	Bennett et al.	704/257
6,622,119	B1	9/2003	Ramaswamy et al.	704/9
6,629,066	B1	9/2003	Jackson et al.	704/9
6,631,346	B1	10/2003	Karaorman et al.	704/9
6,631,351	B1	10/2003	Ramachandran et al.	704/270
6,633,846	B1	10/2003	Bennett et al.	704/257
6,643,620	B1	11/2003	Contolini et al.	704/270
6,650,747	B1	11/2003	Bala et al.	379/265.06
6,658,388	B1	12/2003	Kleindienst et al.	704/275
6,678,680	B1	1/2004	Woo	707/6
6,681,206	B1	1/2004	Gorin et al.	704/243
6,691,151	B1	2/2004	Cheyer et al.	709/202
6,701,294	B1	3/2004	Ball et al.	704/257
6,704,396	B2	3/2004	Parolkar et al.	379/88.17
6,704,576	B1 *	3/2004	Brachman et al.	455/503
6,704,708	B1	3/2004	Pickering	704/235
6,708,150	B1	3/2004	Hirayama et al.	704/243
6,721,001	B1	4/2004	Berstis	348/231.3
6,721,706	B1	4/2004	Strubbe et al.	704/275
6,735,592	B1	5/2004	Neumann et al.	707/101
6,741,931	B1	5/2004	Kohut et al.	701/209
6,742,021	B1	5/2004	Halverson et al.	709/218
6,745,161	B1	6/2004	Arnold et al.	704/7
6,751,591	B1	6/2004	Gorin et al.	704/257
6,751,612	B1	6/2004	Schuetze et al.	707/4
6,754,485	B1	6/2004	Obradovich et al.	455/414.1
6,754,627	B2	6/2004	Woodward	704/235
6,757,544	B2	6/2004	Rangarajan et al.	455/456.1
6,757,718	B1	6/2004	Halverson et al.	709/218
6,795,808	B1	9/2004	Strubbe et al.	704/275
6,801,604	B2	10/2004	Maes et al.	379/88.17
6,801,893	B1	10/2004	Backfried et al.	704/257
6,829,603	B1	12/2004	Chai et al.	707/5
6,832,230	B1	12/2004	Zilliacus et al.	707/203
6,833,848	B1	12/2004	Wolff et al.	345/719
6,850,603	B1	2/2005	Eberle et al.	379/88.16
6,856,990	B2	2/2005	Barile et al.	707/10
6,865,481	B2	3/2005	Kawazoe et al.	701/211
6,868,380	B2	3/2005	Kroeker	704/240
6,877,001	B2	4/2005	Wolf et al.	707/3
6,877,134	B1	4/2005	Fuller et al.	715/500.1
6,901,366	B1	5/2005	Kuhn et al.	704/275
6,910,003	B1	6/2005	Arnold et al.	704/4
6,912,498	B2	6/2005	Stevens et al.	704/235
6,934,756	B2	8/2005	Maes	709/227
6,937,977	B2	8/2005	Gerson	704/201
6,944,594	B2	9/2005	Busayapongchai et al.	704/275
6,950,821	B2	9/2005	Faybishenko et al.	707/10
6,954,755	B2	10/2005	Reisman	707/10
6,959,276	B2	10/2005	Droppo et al.	704/226
6,968,311	B2	11/2005	Knockeart et al.	704/270
6,973,387	B2	12/2005	Masclet et al.	701/211
6,975,993	B1	12/2005	Keiller	704/275
6,980,092	B2	12/2005	Turnbull et al.	340/425.5
6,983,055	B2	1/2006	Luo	381/313
6,990,513	B2	1/2006	Belfiore et al.	709/203
6,996,531	B2	2/2006	Korall et al.	704/270
7,003,463	B1	2/2006	Maes et al.	704/270.1
7,016,849	B2	3/2006	Arnold et al.	704/275
7,020,609	B2	3/2006	Thrift et al.	704/270.1
7,024,364	B2	4/2006	Guerra et al.	704/270
7,027,586	B2	4/2006	Bushey et al.	379/265.09
7,027,975	B1	4/2006	Pazandak et al.	704/9
7,035,415	B2	4/2006	Belt et al.	381/92
7,043,425	B2	5/2006	Pao	704/211
7,054,817	B2	5/2006	Shao	704/270
7,058,890	B2	6/2006	George et al.	715/728
7,062,488	B1	6/2006	Reisman	707/8
7,069,220	B2	6/2006	Coffman et al.	704/275
7,072,834	B2	7/2006	Zhou	704/244
7,082,469	B2 *	7/2006	Gold et al.	709/231
7,092,928	B1	8/2006	Elad et al.	706/60
7,107,210	B2	9/2006	Deng et al.	704/226
7,107,218	B1	9/2006	Preston	704/270
7,110,951	B1	9/2006	Lemelson et al.	704/270
7,127,400	B2	10/2006	Koch	704/270.1
7,130,390	B2	10/2006	Abburi	379/88.17
7,136,875	B2	11/2006	Anderson et al.	707/104.1
7,137,126	B1	11/2006	Coffman et al.	719/328
7,143,037	B1	11/2006	Chestnut	704/251
7,143,039	B1	11/2006	Stifelman et al.	704/270
7,146,319	B2	12/2006	Hunt	704/254
7,165,028	B2	1/2007	Gong	704/233
7,184,957	B2	2/2007	Brookes et al.	704/246
7,190,770	B2	3/2007	Ando et al.	379/88.01
7,197,069	B2	3/2007	Agazzi et al.	375/233
7,197,460	B1	3/2007	Gupta et al.	704/270.1
7,203,644	B2	4/2007	Anderson et al.	704/246
7,206,418	B2	4/2007	Yang et al.	381/92
7,207,011	B2	4/2007	Mulvey et al.	715/812
7,228,276	B2	6/2007	Omote et al.	704/243
7,231,343	B1	6/2007	Treadgold et al.	704/9
7,236,923	B1	6/2007	Gupta	704/9
7,272,212	B2	9/2007	Eberle et al.	379/88.17
7,277,854	B2	10/2007	Bennett et al.	704/257
7,283,829	B2	10/2007	Christenson et al.	455/461
7,283,951	B2	10/2007	Marchisio et al.	704/9
7,289,606	B2	10/2007	Sibal et al.	379/52
7,299,186	B2	11/2007	Kuzunuki et al.	704/270.1
7,301,093	B2	11/2007	Sater et al.	84/615
7,305,381	B1	12/2007	Poppink et al.	
7,321,850	B2	1/2008	Wakita	704/10
7,328,155	B2	2/2008	Endo et al.	704/251
7,337,116	B2	2/2008	Charlesworth et al.	704/254
7,340,040	B1	3/2008	Saylor et al.	379/67.1
7,366,285	B2	4/2008	Parolkar et al.	379/88.17
7,366,669	B2	4/2008	Nishitani et al.	704/256
7,376,645	B2	5/2008	Bernard	707/3
7,386,443	B1	6/2008	Parthasarathy et al.	704/201
7,398,209	B2	7/2008	Kennewick et al.	704/255
7,406,421	B2	7/2008	Odinak et al.	704/275
7,415,414	B2	8/2008	Azara et al.	704/270
7,421,393	B1	9/2008	Di Fabbrizio et al.	704/275
7,424,431	B2	9/2008	Greene et al.	704/270
7,447,635	B1	11/2008	Konopka et al.	704/275
7,454,608	B2	11/2008	Gopalakrishnan et al.	713/100
7,461,059	B2	12/2008	Richardson et al.	707/5
7,472,020	B2	12/2008	Brulle-Drews	701/211
7,472,060	B1	12/2008	Gorin et al.	704/240
7,478,036	B2	1/2009	Shen et al.	704/9

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,487,088	B1	2/2009	Gorin et al.	704/240
7,493,259	B2	2/2009	Jones et al.	704/257
7,493,559	B1	2/2009	Wolff et al.	715/727
7,502,738	B2	3/2009	Kennewick et al.	704/257
7,516,076	B2	4/2009	Walker et al.	704/275
7,529,675	B2	5/2009	Maes	704/270.1
7,536,297	B2	5/2009	Byrd et al.	704/10
7,536,374	B2	5/2009	Au	706/55
7,542,894	B2	6/2009	Murata	704/9
7,546,382	B2	6/2009	Healey et al.	709/246
7,558,730	B2	7/2009	Davis et al.	704/235
7,574,362	B2	8/2009	Walker et al.	704/275
7,577,244	B2	8/2009	Taschereau	379/218.01
7,606,708	B2	10/2009	Hwang	704/257
7,620,549	B2	11/2009	Di Cristo et al.	704/257
7,634,409	B2	12/2009	Kennewick et al.	704/257
7,640,006	B2	12/2009	Portman et al.	455/412.1
7,640,160	B2	12/2009	Di Cristo et al.	704/257
7,640,272	B2 *	12/2009	Mahajan et al.	
7,676,365	B2	3/2010	Hwang et al.	704/240
7,676,369	B2	3/2010	Fujimoto et al.	704/270
7,684,977	B2	3/2010	Morikawa	704/211
7,693,720	B2 *	4/2010	Kennewick et al.	704/275
7,729,916	B2	6/2010	Coffman et al.	704/270
7,729,918	B2	6/2010	Walker et al.	704/275
7,729,920	B2	6/2010	Chaar et al.	704/275
7,748,021	B2	6/2010	Obradovich	725/105
7,788,084	B2	8/2010	Brun et al.	704/7
7,801,731	B2	9/2010	Odinak et al.	704/275
7,809,570	B2	10/2010	Kennewick et al.	704/257
7,818,176	B2	10/2010	Freeman et al.	
7,831,426	B2	11/2010	Bennett	704/252
7,831,433	B1	11/2010	Belvin et al.	704/275
7,873,519	B2	1/2011	Bennett	704/257
7,873,523	B2	1/2011	Potter et al.	704/275
7,881,936	B2	2/2011	Longe et al.	704/257
7,890,324	B2	2/2011	Bangalore et al.	704/231
7,894,849	B2	2/2011	Kass et al.	455/550.1
7,902,969	B2	3/2011	Obradovich	340/439
7,917,367	B2	3/2011	Di Cristo et al.	704/270.1
7,920,682	B2	4/2011	Byrne et al.	379/88.18
7,949,529	B2	5/2011	Weider et al.	704/270
7,949,537	B2	5/2011	Walker et al.	704/275
7,953,732	B2	5/2011	Frank et al.	707/724
7,974,875	B1	7/2011	Quilici et al.	705/14.4
7,983,917	B2	7/2011	Kennewick et al.	704/257
7,984,287	B2	7/2011	Gopalakrishnan et al.	713/100
8,005,683	B2 *	8/2011	Tessel et al.	704/275
8,015,006	B2	9/2011	Kennewick et al.	704/236
8,060,367	B2	11/2011	Keaveney	704/247
8,069,046	B2	11/2011	Kennewick et al.	704/257
8,073,681	B2	12/2011	Baldwin et al.	704/9
8,077,975	B2	12/2011	Ma et al.	382/187
8,082,153	B2	12/2011	Coffman et al.	704/270
8,086,463	B2	12/2011	Ativanichayaphong et al.	704/275
8,112,275	B2	2/2012	Kennewick et al.	704/240
8,140,327	B2	3/2012	Kennewick et al.	704/226
8,140,335	B2	3/2012	Kennewick et al.	704/257
8,145,489	B2	3/2012	Freeman et al.	704/257
8,150,694	B2	4/2012	Kennewick et al.	704/257
8,155,962	B2	4/2012	Kennewick et al.	704/257
8,170,867	B2	5/2012	Germain	704/9
8,195,468	B2	6/2012	Weider et al.	704/275
8,200,485	B1	6/2012	Lee	704/231
8,219,399	B2	7/2012	Lutz et al.	704/270
8,219,599	B2	7/2012	Tunstall-Pedoe	707/955
8,224,652	B2	7/2012	Wang et al.	704/275
8,255,224	B2	8/2012	Singleton et al.	704/275
8,326,627	B2	12/2012	Kennewick et al.	704/257
8,326,634	B2	12/2012	Di Cristo et al.	704/270.1
8,326,637	B2	12/2012	Baldwin et al.	704/275
8,332,224	B2	12/2012	Di Cristo et al.	704/257
8,447,607	B2	5/2013	Weider et al.	704/250
8,452,598	B2	5/2013	Kennewick et al.	704/257
8,983,839	B2	3/2015	Kennewick et al.	704/254
9,015,049	B2	4/2015	Baldwin et al.	
2001/0039492	A1	11/2001	Nemoto	704/231
2001/0041980	A1	11/2001	Howard et al.	704/270
2001/0049601	A1	12/2001	Kroeker et al.	704/254
2001/0054087	A1	12/2001	Flom et al.	709/218
2002/0015500	A1	2/2002	Belt et al.	381/66
2002/0022927	A1	2/2002	Lemelson et al.	701/301
2002/0029261	A1 *	3/2002	Shibata	709/219
2002/0032752	A1 *	3/2002	Gold et al.	709/218
2002/0035501	A1	3/2002	Handel et al.	705/10
2002/0049805	A1	4/2002	Yamada et al.	709/202
2002/0065568	A1	5/2002	Silfvast et al.	700/94
2002/0069059	A1	6/2002	Smith	704/257
2002/0069071	A1	6/2002	Knockeart et al.	704/275
2002/0082911	A1	6/2002	Dunn et al.	705/14
2002/0087326	A1	7/2002	Lee et al.	704/270.1
2002/0087525	A1	7/2002	Abbott et al.	707/3
2002/0120609	A1	8/2002	Lang et al.	707/1
2002/0124050	A1	9/2002	Middeljans	709/203
2002/0133402	A1	9/2002	Faber et al.	705/14
2002/0138248	A1	9/2002	Corston-Oliver et al.	704/1
2002/0143532	A1	10/2002	McLean et al.	704/235
2002/0143535	A1	10/2002	Kist et al.	704/251
2002/0161646	A1	10/2002	Gailey et al.	705/14
2002/0173961	A1	11/2002	Guerra	704/258
2002/0184373	A1	12/2002	Maes	709/228
2002/0188602	A1	12/2002	Stubler et al.	707/3
2002/0198714	A1	12/2002	Zhou	704/252
2003/0014261	A1	1/2003	Kageyama	704/275
2003/0016835	A1	1/2003	Elko et al.	381/92
2003/0046346	A1	3/2003	Mumick et al.	709/205
2003/0064709	A1	4/2003	Gailey et al.	455/412
2003/0065427	A1	4/2003	Funk et al.	701/1
2003/0088421	A1	5/2003	Maes et al.	704/270.1
2003/0097249	A1	5/2003	Walker et al.	704/1
2003/0110037	A1	6/2003	Walker et al.	704/257
2003/0112267	A1	6/2003	Belrose	345/728
2003/0115062	A1	6/2003	Walker et al.	704/258
2003/0120493	A1	6/2003	Gupta	704/270.1
2003/0135488	A1	7/2003	Amir et al.	707/3
2003/0144846	A1	7/2003	Denenberg et al.	704/277
2003/0158731	A1	8/2003	Falcon et al.	704/231
2003/0161448	A1	8/2003	Parolkar et al.	379/88.17
2003/0182132	A1	9/2003	Niemoeller	704/275
2003/0204492	A1	10/2003	Wolf et al.	707/3
2003/0206640	A1	11/2003	Malvar et al.	381/93
2003/0212550	A1	11/2003	Ubale	704/215
2003/0212558	A1	11/2003	Matula	704/260
2003/0212562	A1	11/2003	Patel et al.	704/275
2003/0225825	A1	12/2003	Healey et al.	709/203
2003/0236664	A1	12/2003	Sharma	704/251
2004/0006475	A1	1/2004	Ehlen et al.	704/270.1
2004/0025115	A1	2/2004	Sienel et al.	715/513
2004/0044516	A1	3/2004	Kennewick et al.	704/5
2004/0098245	A1	5/2004	Walker et al.	704/1
2004/0117804	A1	6/2004	Scahill et al.	719/320
2004/0140989	A1	7/2004	Papageorge	345/700
2004/0158555	A1 *	8/2004	Seedman et al.	707/3
2004/0166832	A1	8/2004	Portman et al.	455/412.1
2004/0167771	A1	8/2004	Duan et al.	704/10
2004/0193408	A1	9/2004	Hunt	704/209
2004/0193420	A1 *	9/2004	Kennewick et al.	704/257
2004/0199375	A1	10/2004	Ehsani et al.	704/4
2004/0205671	A1	10/2004	Sukehiro et al.	715/532
2004/0243417	A9	12/2004	Pitts, III et al.	704/276
2005/0015256	A1	1/2005	Kargman	704/272
2005/0021334	A1	1/2005	Iwahashi	704/240
2005/0021470	A1	1/2005	Martin et al.	705/51
2005/0021826	A1	1/2005	Kumar	709/232
2005/0033574	A1	2/2005	Kim et al.	704/251
2005/0043940	A1	2/2005	Elder	704/9
2005/0080632	A1	4/2005	Endo et al.	704/277
2005/0114116	A1	5/2005	Fiedler	704/201
2005/0125232	A1	6/2005	Gadd	704/270.1
2005/0137850	A1	6/2005	Odell	704/4
2005/0137877	A1	6/2005	Oesterling et al.	704/275
2005/0143994	A1	6/2005	Mori et al.	704/235
2005/0216254	A1	9/2005	Gupta et al.	704/9

(56) **References Cited**

U.S. PATENT DOCUMENTS

2005/0234727	A1	10/2005	Chiu	704/270.1
2005/0246174	A1	11/2005	DeGolia	704/270
2005/0283752	A1	12/2005	Fruchter et al.	717/100
2006/0041431	A1	2/2006	Maes	704/270.1
2006/0047509	A1	3/2006	Ding et al.	704/231
2006/0206310	A1	9/2006	Ravikumar et al.	704/9
2006/0217133	A1	9/2006	Christenson et al.	455/461
2006/0285662	A1	12/2006	Yin et al.	379/88.16
2007/0033005	A1	2/2007	Cristo et al.	704/9
2007/0033020	A1	2/2007	(Kelleher) Francois et al.	704/226
2007/0038436	A1	2/2007	Cristo et al.	704/9
2007/0043574	A1	2/2007	Coffman et al.	704/275
2007/0043868	A1	2/2007	Kumar et al.	709/226
2007/0050191	A1	3/2007	Weider et al.	704/275
2007/0055525	A1	3/2007	Kennewick et al.	704/257
2007/0073544	A1	3/2007	Millett et al.	704/277
2007/0078708	A1	4/2007	Yu et al.	705/14
2007/0078709	A1	4/2007	Rajaram	705/14
2007/0118357	A1	5/2007	Kasravi et al.	704/10
2007/0135101	A1	6/2007	Ramati et al.	455/414.1
2007/0146833	A1*	6/2007	Satomi et al.	358/537
2007/0162296	A1	7/2007	Altberg et al.	705/1
2007/0179778	A1	8/2007	Gong et al.	704/9
2007/0186165	A1	8/2007	Maislos et al.	715/728
2007/0198267	A1	8/2007	Jones et al.	704/257
2007/0214182	A1	9/2007	Rosenberg	707/104.1
2007/0250901	A1	10/2007	McIntire et al.	725/146
2007/0265850	A1	11/2007	Kennewick et al.	704/257
2007/0299824	A1	12/2007	Pan et al.	707/3
2008/0034032	A1	2/2008	Healey et al.	709/203
2008/0065386	A1	3/2008	Cross et al.	704/270
2008/0091406	A1	4/2008	Baldwin et al.	704/4
2008/0103761	A1	5/2008	Printz et al.	704/9
2008/0109285	A1	5/2008	Reuther et al.	705/7
2008/0115163	A1	5/2008	Gilboa et al.	725/34
2008/0133215	A1	6/2008	Sarukkai	704/2
2008/0140385	A1*	6/2008	Mahajan et al.	704/9
2008/0147396	A1	6/2008	Wang	704/246
2008/0147410	A1	6/2008	Odinak	704/270.1
2008/0162471	A1	7/2008	Bernard	707/5
2008/0177530	A1	7/2008	Cross et al.	704/4
2008/0189110	A1	8/2008	Freeman et al.	704/251
2008/0235023	A1	9/2008	Kennewick et al.	704/257
2008/0235027	A1	9/2008	Cross	704/270.1
2008/0319751	A1	12/2008	Kennewick et al.	704/257
2009/0052635	A1	2/2009	Jones et al.	379/88.02
2009/0067599	A1	3/2009	Agarwal et al.	379/114.21
2009/0076827	A1	3/2009	Bulitta et al.	704/275
2009/0106029	A1	4/2009	DeLine et al.	704/275
2009/0117885	A1	5/2009	Roth	455/414.3
2009/0144271	A1	6/2009	Richardson et al.	707/5
2009/0150156	A1	6/2009	Kennewick et al.	704/257
2009/0171664	A1	7/2009	Kennewick et al.	704/257
2009/0216540	A1*	8/2009	Tessel et al.	704/275
2009/0271194	A1	10/2009	Davis et al.	704/235
2009/0273563	A1	11/2009	Pryor	345/157
2009/0276700	A1*	11/2009	Anderson et al.	715/700
2009/0299745	A1	12/2009	Kennewick et al.	704/257
2009/0313026	A1	12/2009	Coffman et al.	704/275
2010/0023320	A1	1/2010	Di Cristo et al.	704/9
2010/0029261	A1	2/2010	Mikkelsen et al.	455/419
2010/0036967	A1*	2/2010	Caine et al.	709/236
2010/0049501	A1	2/2010	Kennewick et al.	704/9
2010/0049514	A1	2/2010	Kennewick et al.	704/233
2010/0057443	A1	3/2010	Di Cristo et al.	704/9
2010/0063880	A1	3/2010	Atsmon et al.	705/14.53
2010/0094707	A1	4/2010	Freer	705/14.54
2010/0145700	A1	6/2010	Kennewick et al.	704/257
2010/0185512	A1	7/2010	Borger et al.	705/14.49
2010/0204986	A1	8/2010	Kennewick et al.	704/226
2010/0204994	A1	8/2010	Kennewick et al.	704/257
2010/0217604	A1	8/2010	Baldwin et al.	704/275
2010/0286985	A1	11/2010	Kennewick et al.	704/257
2010/0299142	A1	11/2010	Freeman et al.	704/9
2010/0312566	A1	12/2010	Odinak et al.	704/275
2011/0022393	A1	1/2011	Waller et al.	704/270
2011/0112827	A1	5/2011	Kennewick et al.	704/9
2011/0131036	A1	6/2011	Di Cristo et al.	704/9
2011/0131045	A1	6/2011	Cristo et al.	704/249
2011/0231182	A1	9/2011	Weider et al.	704/9
2011/0231188	A1	9/2011	Kennewick et al.	704/236
2012/0022857	A1	1/2012	Baldwin et al.	704/9
2012/0101809	A1	4/2012	Kennewick et al.	704/9
2012/0101810	A1	4/2012	Kennewick et al.	704/9
2012/0109753	A1	5/2012	Kennewick et al.	705/14.58
2012/0150636	A1	6/2012	Freeman et al.	705/14.49
2012/0278073	A1	11/2012	Weider et al.	704/235
2015/0066627	A1	3/2015	Freeman et al.	705/14.41
2015/0073910	A1	3/2015	Kennewick et al.	705/14.58
2015/0095159	A1	4/2015	Kennewick et al.	705/14.58

FOREIGN PATENT DOCUMENTS

WO	WO 99/46763	9/1999
WO	WO 00/21232	4/2000
WO	WO 00/46792	8/2000
WO	WO 01/78065	10/2001
WO	WO 2004/072954	8/2004
WO	WO 2007/019318	2/2007
WO	WO 2007/021587	2/2007
WO	WO 2007/027546	3/2007
WO	WO 2007/027989	3/2007
WO	WO 2008/098039	8/2008
WO	WO 2008/118195	10/2008
WO	WO 2009/075912	6/2009
WO	WO 2009/145796	12/2009
WO	WO 2010/096752	8/2010

OTHER PUBLICATIONS

Lin, Bor-shen, et al., "A Distributed Architecture for Cooperative Spoken Dialogue Agents with Coherent Dialogue State and History", ASRU'99, 1999, 4 pages.

Kuhn, Thomas, et al., "Hybrid In-Car Speech Recognition for Mobile Multimedia Applications", Vehicular Technology Conference, IEEE, Jul. 1999, pp. 2009-2013.

Belvin, Robert, et al., "Development of the HRL Route Navigation Dialogue System", Proceedings of the First International Conference on Human Language Technology Research, San Diego, 2001, pp. 1-5.

Lind, R., et al., "The Network Vehicle—A Glimpse into the Future of Mobile Multi-Media" *IEEE Aerosp. Electron. Systems Magazine*, vol. 14, No. 9, Sep. 1999, pp. 27-32.

Zhao, Yilin, "Telematics: Safe and Fun Driving", *IEEE Intelligent Systems*, vol. 17, Issue 1, 2002, pp. 10-14.

Chai et al., "MIND: A Semantics-Based Multimodal Interpretation Framework for Conversational System", *Proceedings of the International CLASS Workshop on Natural, Intelligent and Effective Interaction in Multimodal Dialogue Systems*, Jun. 2002, pp. 37-46.

Cheyer et al., "Multimodal Maps: An Agent-Based Approach", *International Conference on Cooperative Multimodal Communication* (CMC/95), May 24-26, 1995, pp. 111-121.

Elio et al., "On Abstract Task Models and Conversation Policies" in Workshop on Specifying and Implementing Conversation Policies, *Autonomous Agents '99*, Seattle, 1999, 10 pages.

Turunen, "Adaptive Interaction Methods in Speech User Interfaces", Conference on Human Factors in Computing Systems, Seattle, Washington, 2001, pp. 91-92.

Mao, Mark Z., "Automatic Training Set Segmentation for Multi-Pass Speech Recognition", Department of Electrical Engineering, Stanford University, CA, copyright 2005, IEEE, pp. I-685 to I-688.

Vanhoucke, Vincent, "Confidence Scoring and Rejection Using Multi-Pass Speech Recognition", Nuance Communications, Menlo Park, CA, 2005, 4 pages.

Weng, Fuliang, et al., "Efficient Lattice Representation and Generation", Speech Technology and Research Laboratory, SRI International, Menlo Park, CA, 1998, 4 pages.

(56) **References Cited**

OTHER PUBLICATIONS

El Meliani et al., "A Syllabic-Filler-Based Continuous Speech Recognizer for Unlimited Vocabulary", Canadian Conference on Electrical and Computer Engineering, vol. 2, Sep. 5-8, 1995, pp. 1007-1010.

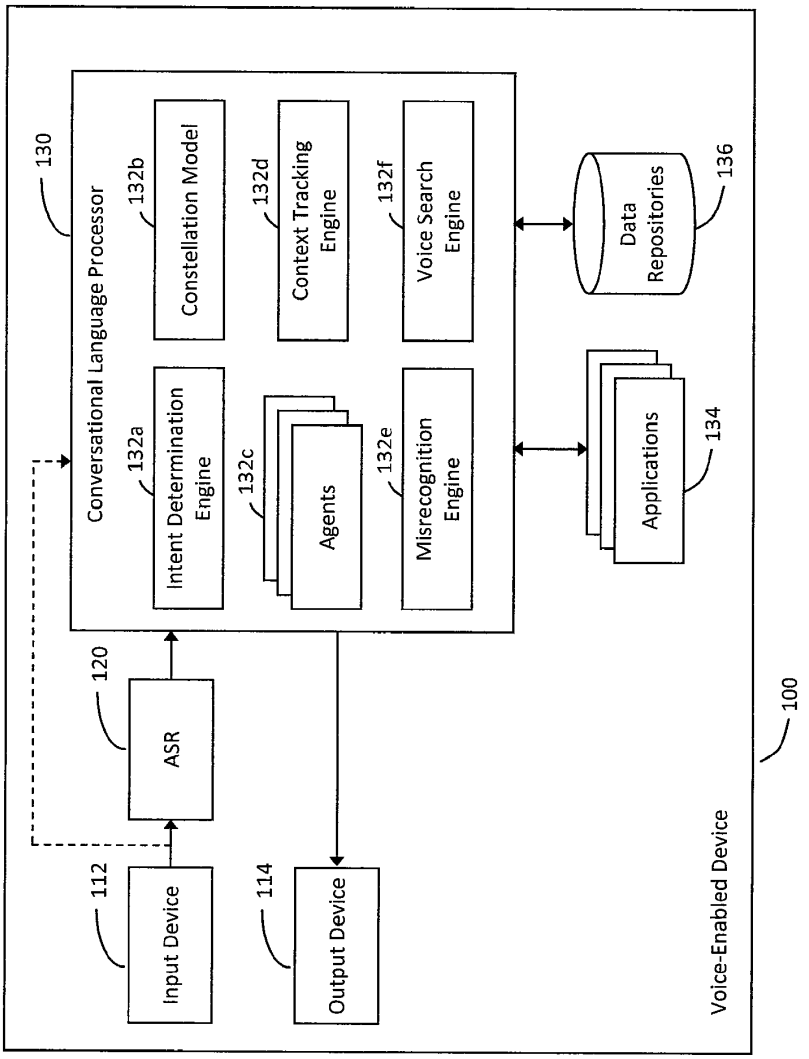
Arrington, Michael, "Google Redefines GPS Navigation Landscape: Google Maps Navigation for Android 2.0", TechCrunch, printed from the Internet <http://www.techcrunch.com/2009/10/28/google-redefines-car-gps-navigation-google-maps-navigation-android/>, Oct. 28, 2009, 4 pages.

Bazzi, Issam et al., "Heterogeneous Lexical Units for Automatic Speech Recognition: Preliminary Investigations", *Processing of the IEEE International Conference on Acoustics, Speech, and Signal Processing*, vol. 3, Jun. 5-9, 2000, XP010507574, pp. 1257-1260.

O'Shaughnessy, Douglas, "Interacting with Computers by Voice: Automatic Speech Recognition and Synthesis", *Proceedings of the IEEE*, vol. 91, No. 9, Sep. 1, 2003, XP011100665, pp. 1272-1305.

Statement in Accordance with the Notice from the European Patent Office dated Oct. 1, 2007 Concerning Business Methods (OJ EPO Nov. 2007, 592-593), XP002456252.

* cited by examiner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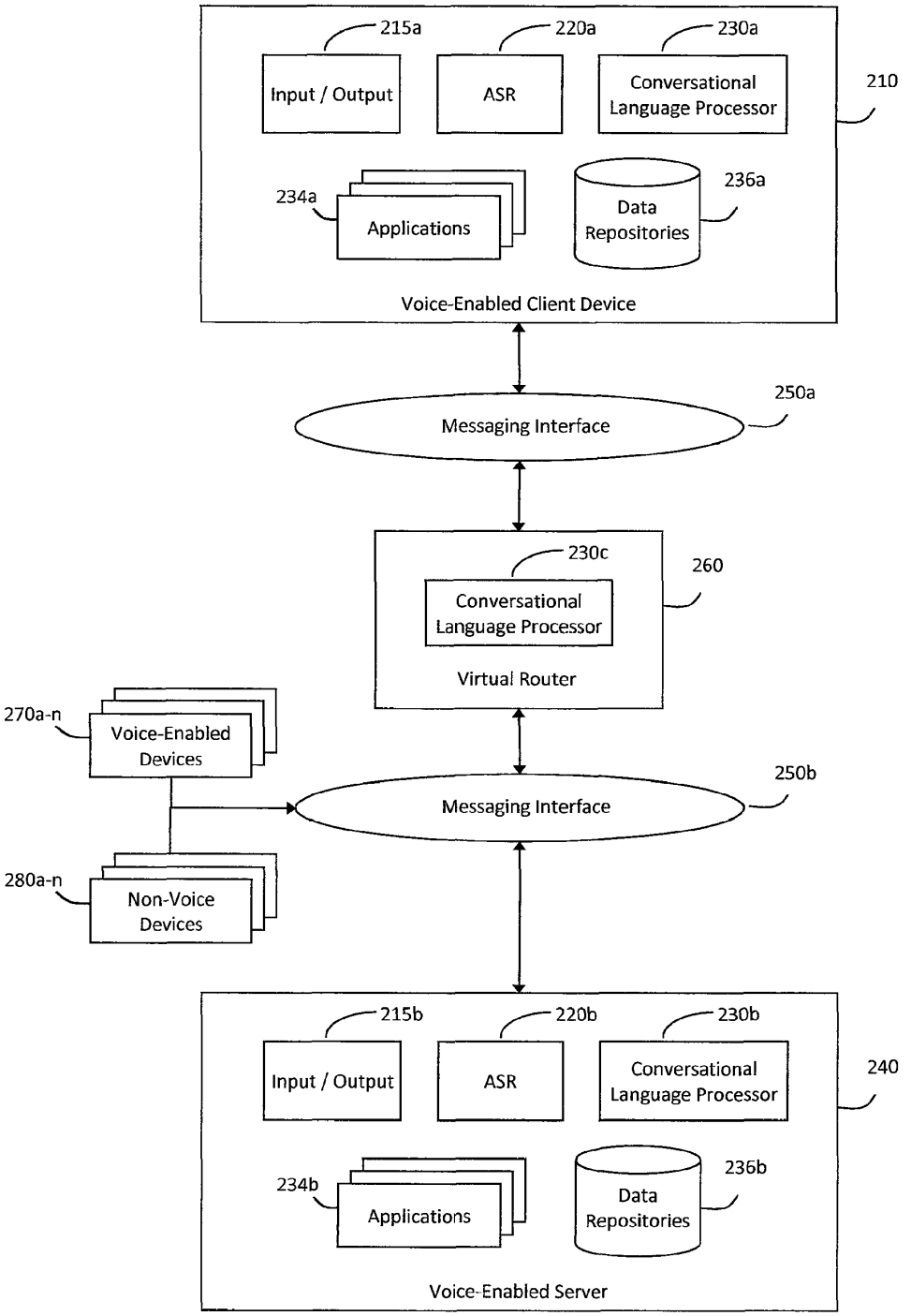
Conversational Language Processor
132a
Intent Determination Engine
132b
Constellation Model
132c
Agents
132d
Context Tracking Engine
132e
Misrecognition Engine
132f
Voice Search Engine
120
ASR
112
Input Device
114
Output Device
Data Repositories
136
Applications
134
100
Voice-Enabled Device

Figure 1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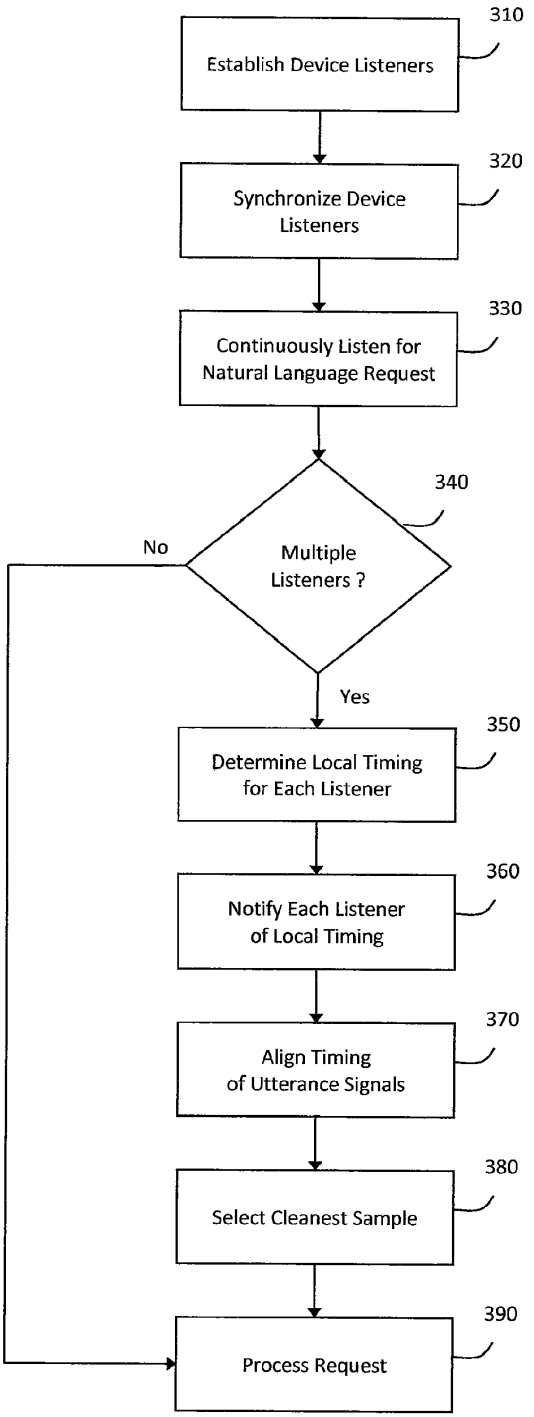
220a
230a
Input / Output
ASR
Conversational Language Processor
210
234a
Applications
Data Repositories
236a
Voice-Enabled Client Device
250a
Messaging Interface
230c
260
Conversational Language Processor
Virtual Router
270a-n
Voice-Enabled Devices
250b
Messaging Interface
280a-n
Non-Voice Devices
215b
220b
230b
Input / Output
ASR
Conversational Language Processor
240
234b
Applications
Data Repositories
236b
Voice-Enabled Server

Figure 2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Establish Device Listeners
320
Synchronize Device Listeners
330
Continuously Listen for Natural Language Request
340
Multiple Listeners ?
No
Yes
350
Determine Local Timing for Each Listener
360
Notify Each Listener of Local Timing
370
Align Timing of Utterance Signals
380
Select Cleanest Sample
390
Process Request

Figure 3

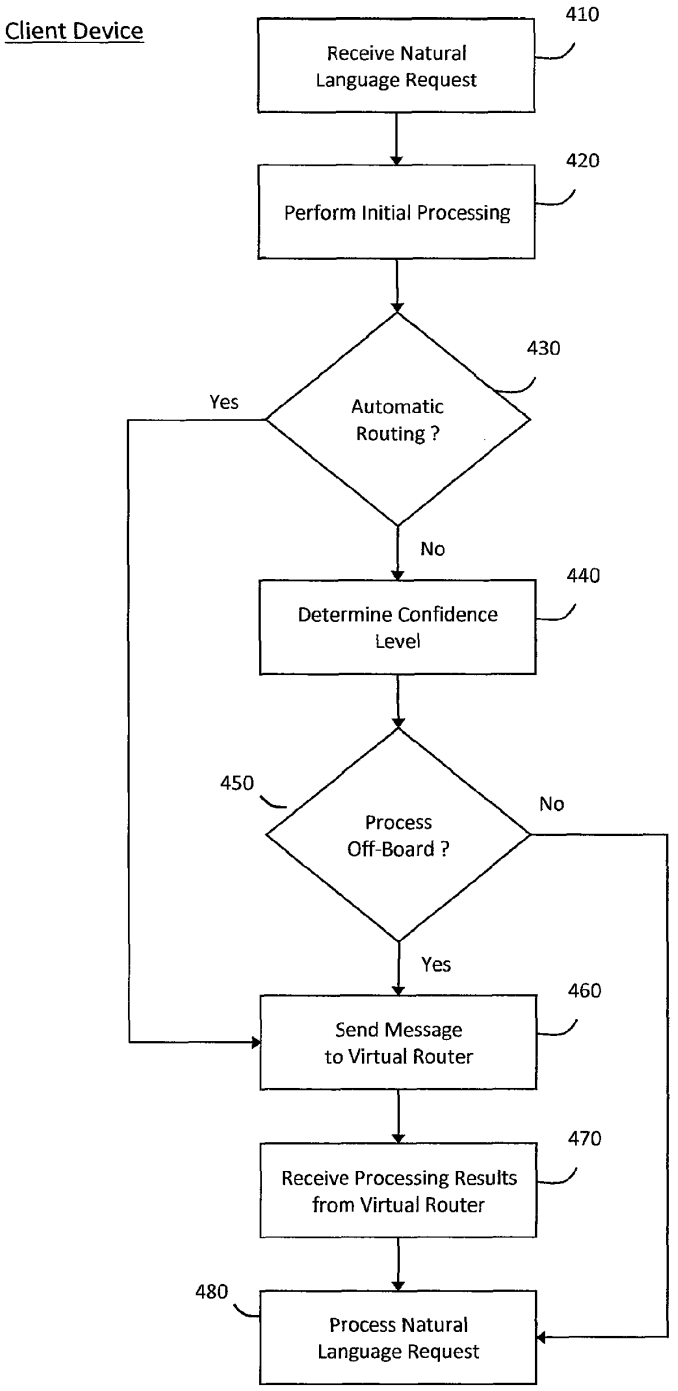
Client Device
410
Receive Natural Language Request
420
Perform Initial Processing
430
Automatic Routing ?
Yes
No
440
Determine Confidence Level
450
Process Off-Board ?
No
Yes
460
Send Message to Virtual Router
470
Receive Processing Results from Virtual Router
480
Process Natural Language Request

Figure 4

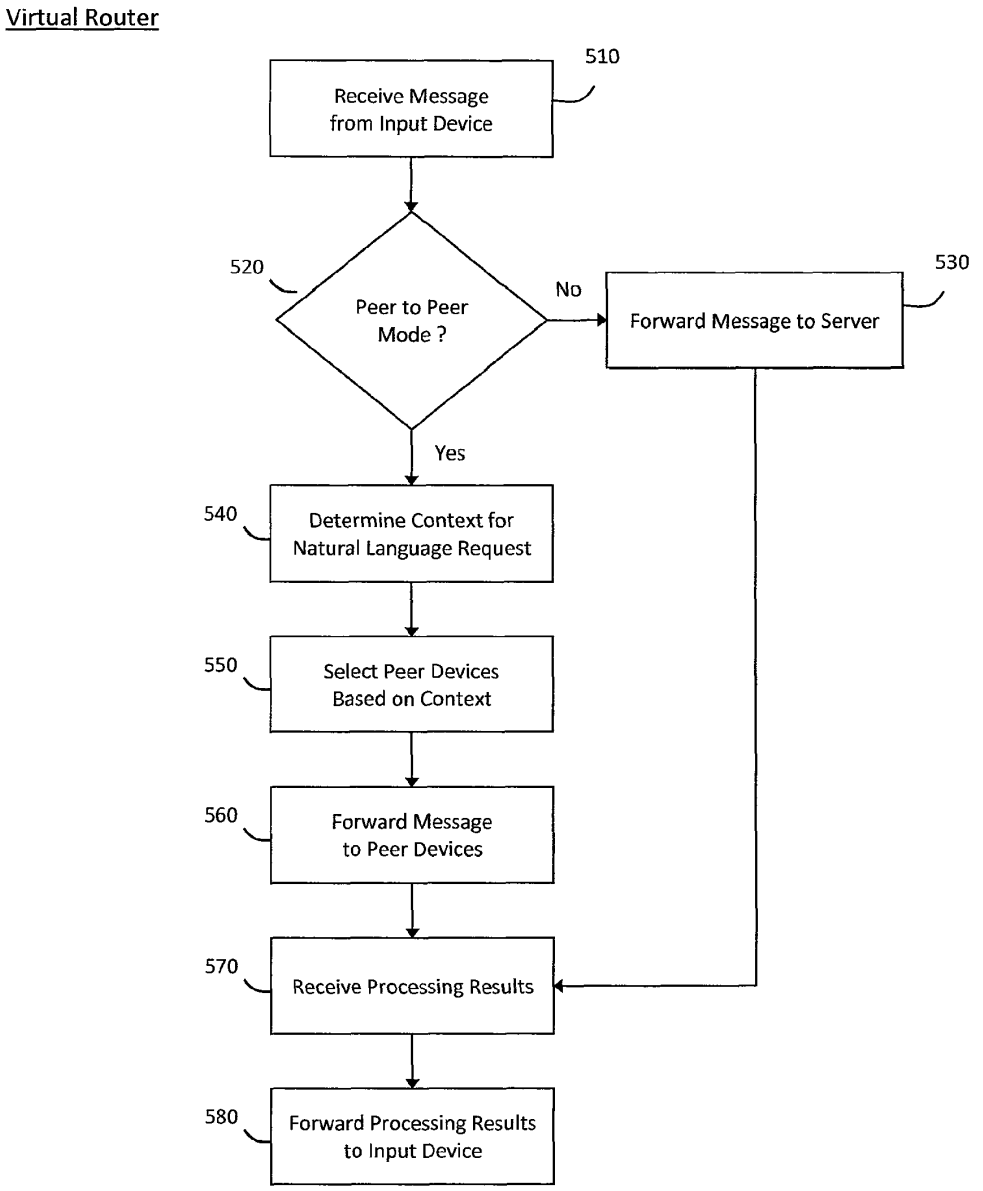
Virtual Router
510
Receive Message from Input Device
520
Peer to Peer Mode ?
No
530
Forward Message to Server
Yes
540
Determine Context for Natural Language Request
550
Select Peer Devices Based on Context
560
Forward Message to Peer Devices
570
Receive Processing Results
580
Forward Processing Results to Input Device

Figure 5

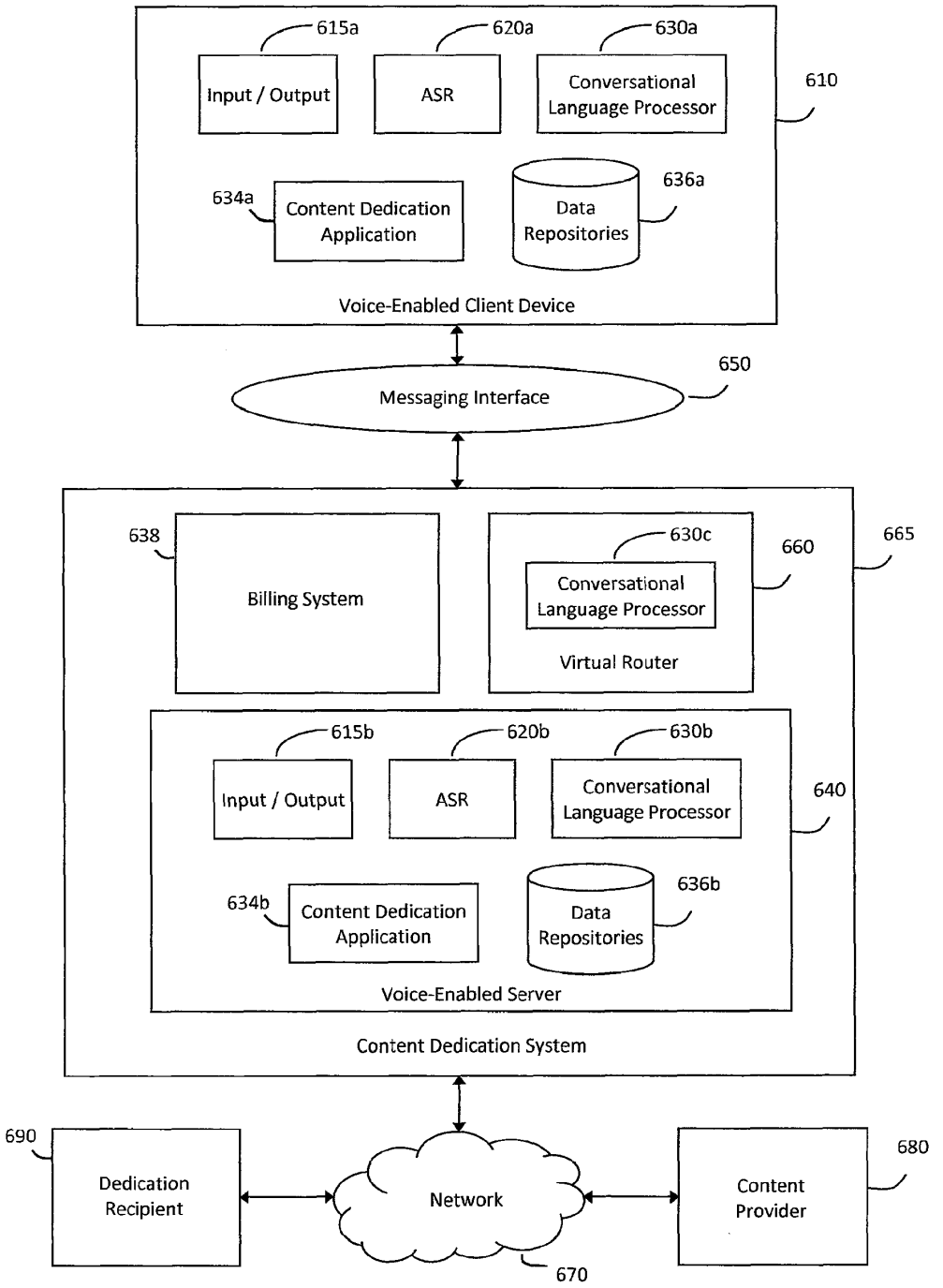
615a
620a
630a
Input / Output
ASR
Conversational Language Processor
610
634a
Content Dedication Application
Data Repositories
636a
Voice-Enabled Client Device
650
Messaging Interface
638
Billing System
630c
Conversational Language Processor
Virtual Router
660
665
615b
620b
630b
Input / Output
ASR
Conversational Language Processor
640
634b
Content Dedication Application
Data Repositories
636b
Voice-Enabled Server
Content Dedication System
690
Dedication Recipient
Network
Content Provider
680
670

Figure 6

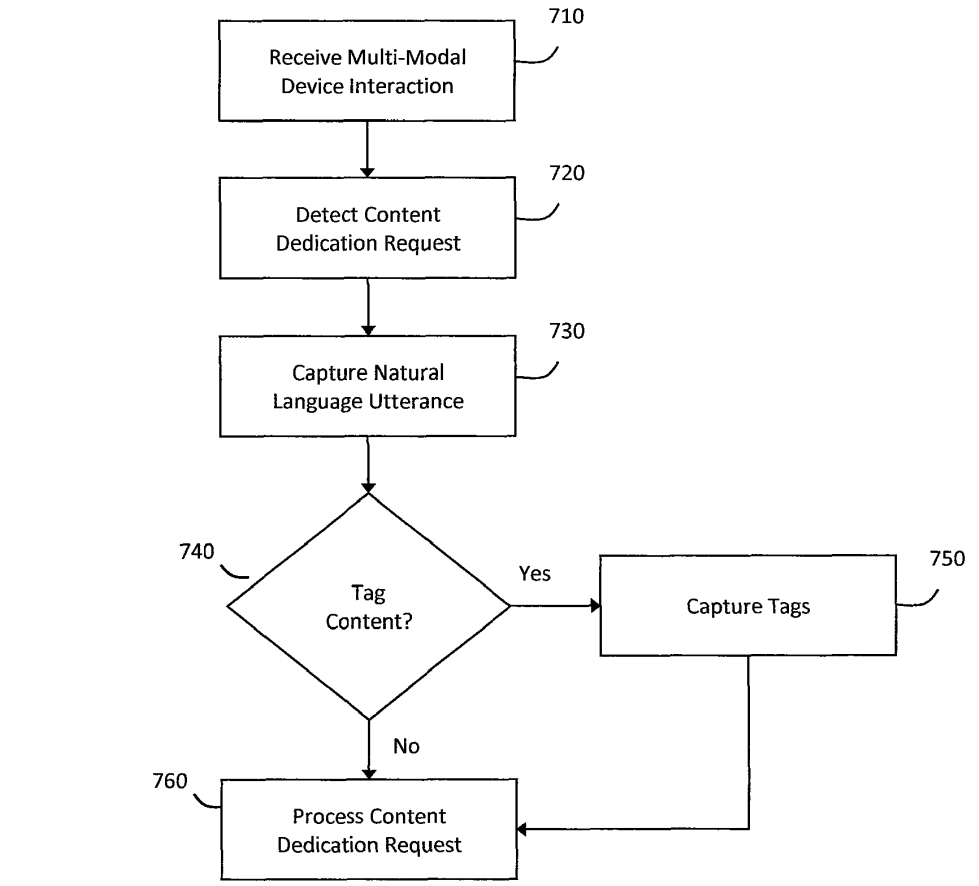
Client Device
710
Receive Multi-Modal Device Interaction
720
Detect Content Dedication Request
730
Capture Natural Language Utterance
740
Tag Content?
Yes
750
Capture Tags
No
760
Process Content Dedication Request

Figure 7

Content Dedication System

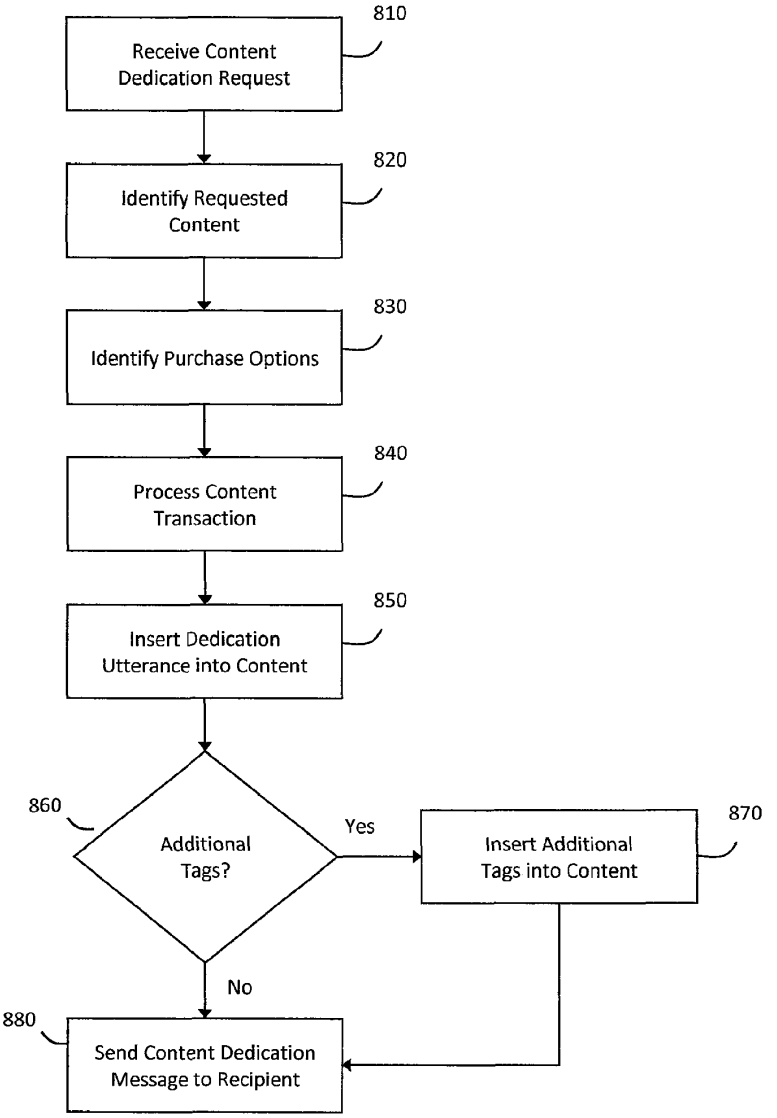

Figure 8

SYSTEM AND METHOD FOR PROVIDING A NATURAL LANGUAGE CONTENT DEDICATION SERVICE

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Patent Application Ser. No. 61/259,820, entitled "System and Method for Providing a Natural Language Content Dedication Service," filed Nov. 10, 2009, the contents of which are hereby incorporated by reference in their entirety.

FIELD OF THE INVENTION

The invention generally relates to providing a natural language content dedication service in a voice services environment, and in particular, to detecting multi-modal device interactions that include requests to dedicate content, identifying the content requested for dedication from natural language utterances included in the multi-modal device interactions, processing transactions for the content requested for dedication, processing natural language to customize the content for recipients of the dedications, and delivering the customized content to the recipients of the dedications.

BACKGROUND OF THE INVENTION

As technology has progressed in recent years, consumer electronic devices have emerged to become nearly ubiquitous in the everyday lives of many people. To meet the increasing demand that has resulted from growth in the functionality and mobility of mobile phones, navigation devices, embedded devices, and other such devices, many devices offer a wealth of features and functions in addition to core applications. Greater functionality also introduces trade-offs, however, including learning curves that often inhibit users from fully exploiting all of the capabilities of their electronic devices. For example, many existing electronic devices include complex human to machine interfaces that may not be particularly user-friendly, which can inhibit mass-market adoption for many technologies. Moreover, cumbersome interfaces often result in otherwise desirable features being difficult to find or use (e.g., because of menus that are complex or otherwise tedious to navigate). As such, many users tend not to use, or even know about, many of the potential capabilities of their devices.

As such, the increased functionality of electronic devices often tends to be wasted, as market research suggests that many users only use only a fraction of the features or applications available on a given device. Moreover, in a society where wireless networking and broadband access are increasingly prevalent, consumers tend to naturally desire seamless mobile capabilities from their electronic devices. Thus, as consumer demand intensifies for simpler mechanisms to interact with electronic devices, cumbersome interfaces that prevent quick and focused interaction become an important concern. Nevertheless, the ever-growing demand for mechanisms to use technology in intuitive ways remains largely unfulfilled.

One approach towards simplifying human to machine interactions in electronic devices has included the use of voice recognition software, which has the potential to enable users to exploit features that would otherwise be unfamiliar, unknown, or difficult to use. For example, a recent survey conducted by the Navteq Corporation, which provides data

used in a variety of applications such as automotive navigation and web-based applications, demonstrates that voice recognition often ranks among the features most desired by consumers of electronic devices. Even so, existing voice user interfaces, when they actually work, still require significant learning on the part of the user.

For example, many existing voice user interface only support requests formulated according to specific command-and-control sequences or syntaxes. Furthermore, many existing voice user interfaces cause user frustration or dissatisfaction because of inaccurate speech recognition. Similarly, by forcing a user to provide pre-established commands or keywords to communicate requests in ways that a system can understand, existing voice user interfaces do not effectively engage the user in a productive, cooperative dialogue to resolve requests and advance a conversation towards a satisfactory goal (e.g., when users may be uncertain of particular needs, available information, device capabilities, etc.). As such, existing voice user interfaces tend to suffer from various drawbacks, including significant limitations on engaging users in a dialogue in a cooperative and conversational manner.

Additionally, many existing voice user interfaces fall short in utilizing information distributed across different domains, devices, and applications in order to resolve natural language voice-based inputs. Thus, existing voice user interfaces suffer from being constrained to a finite set of applications for which they have been designed, or to devices on which they reside. Although technological advancement has resulted in users often having several devices to suit their various needs, existing voice user interfaces do not adequately free users from device constraints. For example, users may be interested in services associated with different applications and devices, but existing voice user interfaces tend to restrict users from accessing the applications and devices as they see fit. Moreover, users typically can only practicably carry a finite number of devices at any given time, yet content or services associated with users' devices other than those currently being used may be desired in various circumstances.

Accordingly, although users tend to have varying needs, where content or services associated with different devices may be desired in various contexts or environments, existing voice technologies tend to fall short in providing an integrated environment in which users can request content or services associated with virtually any device or network. As such, constraints on information availability and device interaction mechanisms in existing voice services environments tend to prevent users from experiencing technology in an intuitive, natural, and efficient way. For instance, when a user wishes to perform a given function using a given electronic device, but does not necessarily know how to go about performing the function, the user typically cannot engage in cooperative multi-modal interactions with the device to simply utter words in natural language to request the function.

Furthermore, relatively simple functions can often be tedious to perform using electronic devices that do not have voice recognition capabilities. For example, purchasing new ring-tones for a mobile phone tends to be a relatively straightforward process, but users must typically navigate several menus and press many different buttons in order to complete the process. In another example, users often listen to music or interact with other media in mobile environments, such that interest in purchasing music, media, or other content may be fleeting or often occur on an impulse basis. Whereas existing human to machine interfaces that

lack voice recognition capabilities typically fall short in providing mechanisms that can readily meet this demand, adding voice recognition to an electronic device can substantially simplify human to machine interaction in a manner that can meet user needs, improve experience, and satisfy potentially transient consumer interests. As such, interaction with electronic devices could be made far more efficient if users were provided with the ability to use natural language in order to exploit buried or otherwise difficult to use functionality.

SUMMARY OF THE INVENTION

According to one aspect of the invention, a system and method for providing a natural language content dedication service may generally operate in a voice services environment that includes one or more electronic devices that can receive multi-modal natural language device interactions. In particular, providing the natural language content dedication service may generally include detecting multi-modal device interactions that include requests to dedicate content, identifying the content requested for dedication from natural language utterances included in the multi-modal device interactions, processing transactions for the content requested for dedication, processing natural language to customize the content for recipients of the dedications, and delivering the customized content to the recipients of the dedications.

According to one aspect of the invention, the natural language content dedication service may operate in a hybrid processing environment, which may generally include a plurality of multi-modal devices configured to cooperatively interpret and process natural language utterances included in the multi-modal device interactions. For example, a virtual router may receive messages that include encoded audio corresponding to natural language utterances contained in the multi-modal device interactions, which may be received at one or more of the plurality of multi-modal devices in the hybrid processing environment. For example, the virtual router may analyze the encoded audio to select a cleanest sample of the natural language utterances and communicate with one or more other devices in the hybrid processing environment to determine an intent of the multi-modal device interactions. The virtual router may then coordinate resolving the multi-modal device interactions based on the intent of the multi-modal device interactions.

According to one aspect of the invention, a method for providing the natural language content dedication service may comprise detecting a multi-modal device interaction at an electronic device, wherein the multi-modal device interaction may include at least a natural language utterance. One or more messages containing information relating to the multi-modal device interaction may then be communicated to the virtual router through a messaging interface. The electronic device may then receive one or more messages (e.g., from the virtual router through message interface), wherein the messages may contain information relating to an intent of the multi-modal device interaction. As such, the multi-modal device interaction may be resolved at the electronic device based on the information contained in the one or more messages received from the virtual router.

According to one aspect of the invention, a system for providing the natural language content dedication service may generally include a voice-enabled client device that can communicate with a content dedication system through the messaging interface. The content dedication system include a voice-enabled server, which may be configured to communicate with the virtual router through another messaging interface, or the content dedication system may alternatively include the virtual router. In addition, the content dedication system may further include a billing system for processing transactions relating to the content dedication service. The natural language content dedication service may be provided on any suitable voice-enabled client device having a suitable combination of input and output devices that can receive and respond to multi-modal device interactions that include natural language utterances, and the input and output devices may be further arranged to receive and respond to any other suitable type of input and output.

According to one aspect of the invention, operating the natural language content dedication service may generally include a user of the voice-enabled client device listening to music, watching video, or otherwise interacting with content and providing a multi-modal natural language request to engage in a transaction to dedicate the music, video, or other content. Furthermore, the voice-enabled client device may be included within the hybrid processing environment that includes the plurality of multi-modal devices, whereby the content dedication request may relate to content played on a different device from the voice-enabled client device, although the content dedication request may relate to any suitable content (i.e., the request need not necessarily relate to played content, as users may provide natural language to request content dedications for any suitable content, including a particular song or video that the user may be thinking about).

According to one aspect of the invention, in response to the voice-enabled client device receiving a multi-modal interaction that includes a natural language utterance, the voice-enabled client device may invoke an Automatic Speech Recognizer (ASR) to generate a preliminary interpretation of the utterance. The ASR may then provide the preliminary interpretation of the utterance to a conversational language processor, which may attempt to determine an intent for the multi-modal interaction. For example, to determine the intent for the multi-modal interaction, the conversational language processor may determine a most likely context for the interaction from the preliminary interpretation of the utterance, any accompanying non-speech inputs in the multi-modal interaction that relate to the utterance, contexts associated with prior requests, short-term and long-term shared knowledge, or any other suitable information for interpreting the multi-modal interaction. Thus, in response to the conversational language processor determining that the intent for the multi-modal interaction relates to a content dedication request, a content dedication application may be invoked to resolve the content dedication request.

According to one aspect of the invention, to resolve the intent of the content dedication request, the conversational language processor may search one or more data repositories that contain content information to identify content matching criteria contained in the content dedication request. Moreover, the conversational language processor may further cooperate with other devices in the hybrid processing environment to search for or otherwise identify the content requested for dedication (e.g., in response to a local data repository not yielding adequate results, another device in the hybrid processing environment having a larger content data repository than the client device may be invoked.). The conversational language processor may then receive appropriate results identifying the content requested for dedication and present the results to the user through the output device (e.g., displaying information about the content, playing a

sample clip of the content, displaying options to purchase the content, recommending similar content, etc.). The results presented through the output device may further include an option to confirm the content dedication, wherein the user may confirm the content dedication in a natural language utterance, a non-speech input, or any suitable combination thereof. The content dedication application may then be invoked to process the content dedication request.

According to one aspect of the invention, to process the content dedication request, the content dedication application may capture a natural language utterance that contains the dedication to accompany the content. The user may then provide the dedication utterance through the voice-enabled input device, and the dedication utterance may then be converted into an electronic signal that the content dedication application captures for the dedication. In addition, the content dedication application may prompt the user to provide any additional tags for the dedicated content (e.g., an image to insert as album art in the dedicated content, an utterance to insert or transcribe into metadata tags for the dedicated content, a non-speech or data input to insert in the metadata tags for the dedicated content, etc.). The content dedication application may further prompt the user to identify a recipient of the dedication, wherein the user may provide any suitable multi-modal input that includes information identifying the recipient of the content dedication. The content dedication application may then route the request to the content dedication system, which may process a transaction for the content dedication.

According to one aspect of the invention, processing the transaction for the content dedication may include the content dedication system receiving encoded audio corresponding to the dedication utterance through the messaging interface. The content dedication system may then insert the encoded audio corresponding to the dedication utterance within the dedicated content, verbally annotate the dedicated content with the encoded audio, and/or transcribe the dedication utterance into a textual annotation for the dedicated content. Similarly, any utterances to insert into the metadata tags for the dedicated content may provide further verbal annotations for the dedicated content, and any such utterances may also be transcribed into text to provide further textual annotations for the dedicated content. The content dedication system may then invoke a content dedication application hosted on the voice-enabled server to process the request. In particular, the content dedication application hosted on the voice-enabled server may identify the content requested for dedication (e.g., if the content dedication application on the voice-enabled client device was unable to suitably identify the requested content, or the information communicated from the voice-enabled client device may identify the requested content if the content dedication application on the voice-enabled client device was able to suitably identify the requested content, etc.). In response to identifying the content to be dedicated, the content dedication system may then communicate with the billing system to process an appropriate transaction for the dedication request based on a selected purchase option for the dedication request.

According to one aspect of the invention, the content dedication system may support various purchase options to provide users with flexibility in requesting content dedications. For example, a buy-to-own purchase option may include the content dedication system purchasing full rights to the content from an appropriate content provider. The billing system may then charge the user of the voice-enabled client device an appropriate amount that encompasses the cost for purchasing the rights to the content from the content provider and a service charge for customizing the content with the dedication and any additional tags and subsequently delivering the customized content to the dedication recipient. The user may be charged in a similar manner under a pay-to-play purchase option, except that the rights purchased from the content provider may be limited (e.g., to a predetermined number of plays). Thus, the cost for purchasing the content from the content provider may be somewhat less under the pay-to-play purchase option, such that the billing system may charge the user somewhat less under the pay-to-play purchase option. Under a paid subscription purchase option, the user may pay a periodic service charge to the content dedication system that permits the user to make content dedications based on terms of the subscription (e.g., a predetermined number an unlimited number of content dedications may be made in a subscription period depending on the particular terms of the user's subscription). Furthermore, other purchase options may be suitably employed, as will be apparent.

According to one aspect of the invention, a service provider associated with the content dedication system may negotiate agreements with content providers to determine the manner in which revenues for content transactions will be shared between the content dedication system and the content providers. For example, an agreement may permit a particular content provider to keep all of the revenue for transactions that include purchasing content from the content provider, while the service provider associated with the content dedication system agrees to recoup any such costs from users. In another example, an agreement may share revenue for content transactions between a content provider and the service provider. Thus, the agreements may generally include any suitable arrangements that define the manner in which content providers and the service provider agree to divide revenue for transactions in, which the content dedication system purchases content from the content provider, while the service provider associated with the content dedication system may be responsible for billing users for any natural language aspects of the content dedication service (e.g., for inserting dedication utterances, transcribing utterances into metadata tags, delivering the content to recipients, etc.).

According to one aspect of the invention, in response to purchasing the requested content from an appropriate service provider and determining the appropriate billing options for the content dedication, the content dedication system may insert the natural language dedication utterance into the dedicated content, verbally annotate the dedicated content with the dedication utterance, or otherwise associate the content with the dedication utterance. Furthermore, the content dedication system may determine whether any additional tags have been specified for the dedicated content and insert such additional tags into the dedicated content, as appropriate (e.g., inserting an image or picture into metadata tags corresponding to album art for the dedicated content, transcribing natural language utterances, non-voice, and/or data inputs into text and inserting such text into the metadata tags for the dedicated content, etc.). The content dedication system may then send a content dedication message to the recipient of the dedication, wherein the message may include a link that the recipient can select to stream, download, or otherwise access the dedicated content, the dedication utterance, etc.). Thus, the content dedication message may generally notify the recipient that content has been dedicated to the recipient and provide various mechanisms for the recipient to access the content dedication, as will be

apparent. Furthermore, if the purchase option selected for the content dedication includes the buy-to-own purchase option or another purchase option that confers full rights to the dedicated content, the recipient may then own the full rights to the dedicated content, otherwise the recipient may own rights with respect to the dedicated content based on whatever terms the selected purchase option provides.

Other objects and advantages of the invention will be apparent based on the following drawings and detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** illustrates a block diagram of an exemplary voice-enabled device that can be used for hybrid processing in a natural language voice services environment, according to one aspect of the invention.

FIG. **2** illustrates a block diagram of an exemplary system for hybrid processing in a natural language voice service environment, according to one aspect of the invention.

FIG. **3** illustrates a flow diagram of an exemplary method for initializing various devices that cooperate to perform hybrid processing in a natural language voice services environment, according to one aspect of the invention.

FIGS. **4-5** illustrate flow diagrams of exemplary methods for hybrid processing in a natural language voice services environment, according to one aspect of the invention.

FIG. **6** illustrates a block diagram of an exemplary system for providing a natural language content dedication service, according to one aspect of the invention.

FIGS. **7-8** illustrate flow diagrams of exemplary methods for providing a natural language content dedication service, according to one aspect of the invention.

DETAILED DESCRIPTION

According to one aspect of the invention, FIG. **1** illustrates a block diagram of an exemplary voice-enabled device **100** that can be used for hybrid processing in a natural language voice services environment. As will be apparent from the further description to be provided herein, the voice-enabled device **100** illustrated in FIG. **1** may generally include an input device **112**, or a combination of input devices **112**, which may enable a user to interact with the voice-enabled device **100** in a multi-modal manner. In particular, the input devices **112** may generally include any suitable combination of at least one voice input device **112** (e.g., a microphone) and at least one non-voice input device **112** (e.g., a mouse, touch-screen display, wheel selector, etc.). As such, the input devices **112** may include any suitable combination of electronic devices having mechanisms for receiving both voice-based and non-voice-based inputs (e.g., a microphone coupled to one or more of a telematics device, personal navigation device, mobile phone, VoIP node, personal computer, media device, embedded device, server, or other electronic device).

In one implementation, the voice-enabled device **100** may enable the user to engage in various multi-modal conversational interactions, which the voice-enabled device **100** may process in a free-form and cooperative manner to execute various tasks, resolve various queries, or otherwise resolve various natural language requests included in the multi-modal interactions. For example, in one implementation, the voice-enabled device **100** may include various natural language processing components, including at least a voice-click module coupled to the one or more input devices **112**, as described in further detail in co-pending U.S. patent application Ser. No. 12/389,678, entitled "System and Method for Processing Multi-Modal Device Interactions in a Natural Language Voice Services Environment," filed Feb. 20, 2009, the contents of which are hereby incorporated by reference in their entirety. Thus, as will be described in further detail herein, the one or more input devices **112** and the voice-click module may be collectively configured to process various multi-modal interactions between the user and the voice-enabled device **100**.

For example, in one implementation, the multi-modal interactions may include at least one natural language utterance, wherein the natural language utterance may be converted into an electronic signal. The electronic signal may then be provided to an Automatic Speech Recognizer (ASR) **120**, which may also be referred to as a speech recognition engine **120** and/or a multi-pass speech recognition engine **120**. In response to receiving the electronic signal corresponding to the utterance, the ASR **120** may generate one or more preliminary interpretations of the utterance and provide the preliminary interpretation to a conversational language processor **130**. Additionally, in one implementation, the multi-modal interactions may include one or more non-voice interactions with the one or more input devices **112** (e.g., button pushes, multi-touch gestures, point of focus or attention focus selections, etc.). As such, the voice-click module may extract context from the non-voice interactions and provide the context to the conversational language processor **130** for use in generating an interpretation of the utterance (i.e., via the dashed line illustrated in FIG. **1**). As such, as described in greater detail below, the conversational language processor **130** may analyze the utterance and any accompanying non-voice interactions to determine an intent of the multi-modal interactions with the voice-enabled device **100**.

In one implementation, as noted above, the voice-enabled device **100** may include various natural language processing components that can support free-form utterances and/or other forms of non-voice device interactions, which may liberate the user from restrictions relating to the manner of formulating commands, queries, or other requests. As such, the user may provide the utterance to the voice input device **112** using any manner of speaking, and may further provide other non-voice interactions to the non-voice input device **112** to request any content or service available through the voice-enabled device **100**. For instance, in one implementation, in response to receiving the utterance at the voice input device **112**, the utterance may be processed using techniques described in U.S. patent application Ser. No. 10/452,147, entitled "Systems and Methods for Responding to Natural Language Speech Utterance," which issued as U.S. Pat. No. 7,398,209 on Jul. 8, 2008, and co-pending U.S. patent application Ser. No. 10/618,633, entitled "Mobile Systems and Methods for Responding to Natural Language Speech Utterance," filed Jun. 15, 2003, the contents of which are hereby incorporated by reference in their entirety. In addition, the user may interact with one or more of the non-voice input devices **112** to provide buttons pushes, multi-touch gestures, point of focus or attention focus selections, or other non-voice device interactions, which may provide further context or other information relating to the natural language utterances and/or the requested content or service.

In one implementation, the voice-enabled device **100** may be coupled to one or more additional systems that may be configured to cooperate with the voice-enabled device **100** to interpret or otherwise process the multi-modal interactions that include combinations of natural language utter-

ances and/or non-voice device interactions. For example, as will be described in greater detail below in connection with FIG. **2**, the one or more additional systems may include one or more multi-modal voice-enabled devices having similar natural language processing capabilities to the voice-enabled device **100**, one or more non-voice devices having data retrieval and/or task execution capabilities, and a virtual router that coordinates interaction among the voice-enabled device **100** and the additional systems. As such, the voice-enabled device **100** may include an interface to an integrated natural language voice services environment that includes a plurality of multi-modal devices, wherein the user may request content or services available through any of the multi-modal devices.

For example, in one implementation, the conversational language processor **130** may include a constellation model **132***b* that provides knowledge relating to content, services, applications, intent determination capabilities, and other features available in the voice services environment, as described in co-pending U.S. patent application Ser. No. 12/127,343, entitled "System and Method for an Integrated, Multi-Modal, Multi-Device Natural Language Voice Services Environment," filed May 27, 2008, the contents of which are hereby incorporated by reference in their entirety. As such, the voice-enabled device **100** may have access to shared knowledge relating to natural language processing capabilities, context, prior interactions, domain knowledge, short-term knowledge, long-term knowledge, and cognitive models for the various systems and multi-modal devices, providing a cooperative environment for resolving the multi-modal interactions received at the voice-enabled device **100**.

In one implementation, the input devices **112** and the voice-click module coupled thereto may be configured to continually monitor for one or more multi-modal interactions received at the voice-enabled device **100**. In particular, the input devices **112** and the voice-click module may continually monitor for one or more natural language utterances and/or one or more distinguishable non-voice device interactions, which may collectively provide the relevant context for retrieving content, executing tasks, invoking services or commands, or processing any other suitable requests. Thus, in response to detecting one or more multi-modal interactions, the input devices **112** and/or the voice-click module may signal the voice-enabled device **100** that an utterance and/or a non-voice interaction have been received. For example, in one implementation, the non-voice interaction may provide context for sharpening recognition, interpretation, and understanding of an accompanying utterance, and moreover, the utterance may provide further context for enhancing interpretation of the accompanying non-voice interaction. Accordingly, the utterance and the non-voice interaction may collectively provide relevant context that various natural language processing components may use to determine an intent of the multi-modal interaction that includes the utterance and the non-voice interaction.

In one implementation, as noted above, processing the utterance included in the multi-modal interaction may be initiated at the ASR **120**, wherein the ASR **120** may generate one or more preliminary interpretations of the utterance. In one implementation, to generate the preliminary interpretations of the utterance, the ASR **120** may be configured to recognize one or more syllables, words, phrases, or other acoustic characteristics from the utterance using one or more dynamic recognition grammars and/or acoustic models. For example, in one implementation, the ASR **120** may use the dynamic recognition grammars and/or the acoustic models to recognize a stream of phonemes from the utterance based on phonetic dictation techniques, as described in U.S. patent application Ser. No. 11/513,269, entitled "Dynamic Speech Sharpening," which issued as U.S. Pat. No. 7,634,409 on Dec. 15, 2009, the contents of which are hereby incorporated by reference in their entirety. In addition, the dynamic recognition grammars and/or the acoustic models may include unstressed central vowels (e.g., "schwa"), which may reduce a search space for recognizing the stream of phonemes for the utterance.

Furthermore, in one implementation, the ASR **120** may be configured as a multi-pass speech recognition engine **120**, as described in U.S. patent application Ser. No. 11/197,504, entitled "Systems and Methods for Responding to Natural Language Speech Utterance," which issued as U.S. Pat. No. 7,640,160 on Dec. 29, 2009, the contents of which are hereby incorporated by reference in their entirety. The multi-pass speech recognition **120** may be configured to initially invoke a primary speech recognition engine to generate a first transcription of the utterance, and further to optionally subsequently invoke one or more secondary speech recognition engines to generate one or more secondary transcriptions of the utterance. In one implementation, the first transcription may be generated using a large list dictation grammar, while the secondary transcriptions may be generated using virtual dictation grammars having decoy words for out-of-vocabulary words, reduced vocabularies derived from a conversation history, or other dynamic recognition grammars. For example, in one implementation, if a confidence level for the first transcription does not meet or exceed a threshold, the secondary speech recognition engines may be invoked to sharpen the interpretation of the primary speech recognition engine. It will be apparent, however, that the multi-pass speech recognition engine **120** may interpret the utterance using any suitable combination of techniques that results in a preliminary interpretation derived from a plurality of transcription passes for the utterance (e.g., the secondary speech recognition engines may be invoked regardless of the confidence level for the first transcription, or the primary speech recognition engine and/or the secondary speech recognition engines may employ recognition grammars that are identical or optimized for a particular interpretation context, etc.).

Accordingly, in one implementation, the dynamic recognition grammars used in the ASR **120** may be optimized for different languages, contexts, domains, memory constraints, and/or other suitable criteria. For example, in one implementation, the voice-enabled device **100** may include one or more applications **134** that provide content or services for a particular context or domain, such as a navigation application **134**. As such, in response to the ASR **120** determining navigation as the most likely context for the utterance, the dynamic recognition grammars may be optimized for various physical, temporal, directional, or other geographical characteristics (e.g., as described in co-pending U.S. patent application Ser. No. 11/954,064, entitled "System and Method for Providing a Natural Language Voice User Interface in an Integrated Voice Navigation Services Environment," filed Dec. 11, 2007, the contents of which are hereby incorporated by reference in their entirety). In another example, an utterance containing the word "traffic" may be subject to different interpretations depending on whether the user intended a navigation context (i.e., traffic on roads), a music context (i.e., the 1960's rock band), or a movie context (i.e., the Steven Soderbergh film). Accordingly, the recognition grammars used in the ASR **120** may be dynamically adapted to optimize accurate recognition for any given

utterance (e.g., in response to incorrectly interpreting an utterance to contain a particular word or phrase, the incorrect interpretation may be removed from the recognition grammar to prevent repeating the incorrect interpretation).

In one implementation, in response to the ASR **120** generating the preliminary interpretations of the utterance included in the multi-modal interaction using one or more of the techniques described above, the ASR **120** may provide the preliminary interpretations to the conversational language processor **130**. The conversational language processor **130** may generally include various natural language processing components, which may be configured to model human-to-human conversations or interactions. Thus, the conversational language processor **130** may invoke one or more of the natural language processing components to further analyze the preliminary interpretations of the utterance and any accompanying non-voice interactions to determine the intent of the multi-modal interactions received at the voice-enabled device **100**.

In one implementation, the conversational language processor **120** may invoke an intent determination engine **130***a* configured to determine the intent of the multi-modal interactions received at the voice-enabled device **100**. In one implementation, the intent determination engine **130***a* may invoke a knowledge-enhanced speech recognition engine that provides long-term and short-term semantic knowledge for determining the intent, as described in co-pending U.S. patent application Ser. No. 11/212,693, entitled "Mobile Systems and Methods of Supporting Natural Language Human-Machine Interactions," filed Aug. 29, 2005, the contents of which are hereby incorporated by reference in their entirety. For example, in one implementation, the semantic knowledge may be based on a personalized cognitive model derived from one or more prior interactions with the user, a general cognitive model derived from one or more prior interactions with various different users, and/or an environmental cognitive model derived from an environment associated with the user, the voice-enabled device **100**, and/or the voice services environment (e.g., ambient noise characteristics, location sensitive information, etc.).

Furthermore, the intent determination engine **132***a* may invoke a context tracking engine **132***d* to determine the context for the multi-modal interactions. For example, any context derived from the natural language utterance and/or the non-voice interactions in the multi-modal interactions may be pushed to a context stack associated with the context tracking engine **132***d*, wherein the context stack may include various entries that may be weighted or otherwise ranked according to one or more contexts identified from the cognitive models and the context for the current multi-modal interactions. As such, the context tracking engine **132***d* may determine one or more entries in the context stack that match information associated with the current multi-modal interactions to determine a most likely context for the current multi-modal interactions. The context tracking engine **132***d* may then provide the most likely context to the intent determination engine **132***a*, which may determine the intent of the multi-modal interactions in view of the most likely context.

In addition, based on the most likely context, the intent determination engine **132***a* may reference the constellation model **132***b* to determine whether to invoke any of the various systems or multi-modal devices in the voice services environment. For example, as noted above, the constellation model **132***b* may provide intent determination capabilities, domain knowledge, semantic knowledge, cognitive models, and other information available through the various systems and multi-modal devices. As such, the intent determination engine **132***a* may reference the constellation model **132***b* to determine whether one or more of the other systems and/or multi-modal devices should be engaged to participate in determining the intent of the multi-modal interactions. For example, in response to the constellation model **132***b* indicating that one or more of the other systems and/or multi-modal devices have natural language processing capabilities optimized for the most likely context, the intent determination engine **132***a* may forward information relating to the multi-modal interactions to such systems and/or multi-modal devices, which may then determine the intent of the multi-modal interactions and return the intent determination to the voice-enabled device **100**.

In one implementation, the conversational language processor **130** may be configured to engage the user in one or more cooperative conversations to resolve the intent or otherwise process the multi-modal interactions, as described in co-pending U.S. patent application Ser. No. 11/580,926, entitled "System and Method for a Cooperative Conversational Voice User Interface," filed Oct. 16, 2006, the contents of which are hereby incorporated by reference in their entirety. In particular, the conversational language processor **130** may generally identify a conversational goal for the multi-modal interactions, wherein the conversational goal may be identifying from analyzing the utterance, the non-voice interactions, the most likely context, and/or the determined intent. As such, the conversational goal identified for the multi-modal interactions may generally control the cooperative conversation between the conversational language processor **130** and the user. For example, the conversational language processor **130** may generally engage the user in one or more query conversations, didactic conversations, and/or exploratory conversations to resolve or otherwise process the multi-modal interactions.

In particular, the conversational language processor **130** may engage the user in a query conversation in response to identifying that the conversational goal relates to retrieving discrete information or performing a particular function. Thus, in a cooperative query conversation, the user may lead the conversation towards achieving the particular conversational goal, while the conversational language processor **130** may initiate one or more queries, tasks, commands, or other requests to achieve the goal and thereby support the user in the conversation. In response to ambiguity or uncertainty in the intent of the multi-modal interaction, the conversational language processor **130** may engage the user in a didactic conversation to resolve the ambiguity or uncertainty (e.g., where noise or malapropisms interfere with interpreting the utterance, multiple likely contexts cannot be disambiguated, etc.). As such, in a cooperative didactic conversation, the conversational language processor **130** may lead the conversation to clarify the intent of the multi-modal interaction (e.g., generating feedback provided through an output device **114**), while the user may regulate the conversation and provide additional multi-modal interactions to clarify the intent. In response to determining the intent of the multi-modal interactions with suitable confidence, with the intent indicating an ambiguous or uncertain goal, the conversational language processor **130** may engage the user in an exploratory conversation to resolve the goal. In a cooperative exploratory conversation, the conversational language processor **130** and the user may share leader and supporter roles, wherein the ambiguous or uncertain goal may be improvised or refined over a course of the conversation.

Thus, the conversational language processor **130** may generally engage in one or more cooperative conversations to determine the intent and resolve a particular goal for the multi-modal interactions received at the voice-enabled device **100**. The conversational language processor **130** may then initiate one or more queries, tasks, commands, or other requests in furtherance of the intent and the goal determined for the multi-modal interactions. For example, in one implementation, the conversational language processor **130** may invoke one or more agents **132***c* having capabilities for processing requests in a particular domain or application **134**, a voice search engine **132***f* having capabilities for retrieving information requested in the multi-modal interactions (e.g., from one or more data repositories **136**, networks, or other information sources coupled to the voice-enabled device **100**), or one or more other systems or multi-modal devices having suitable processing capabilities for furthering the intent and the goal for the multi-modal interactions (e.g., as determined from the constellation model **132***b*).

Additionally, in one implementation, the conversational language processor **130** may invoke an advertising application **134** in relation to the queries, tasks, commands, or other requests initiated to process the multi-modal interactions, wherein the advertising application **134** may be configured, to select one or more advertisements that may be relevant to the intent and/or the goal for the multi-modal interactions, as described in co-pending U.S. patent application Ser. No. 11/671,526, entitled "System and Method for Selecting and Presenting Advertisements Based on Natural Language Processing of Voice-Based Input," filed Feb. 6, 2007, the contents of which are hereby incorporated by reference in their entirety.

In one implementation, in response to receiving results from any suitable combination of queries, tasks, commands, or other requests processed for the multi-modal interactions, the conversational language processor **130** may format the results for presentation to the user through the output device **114**. For example, the results may be formatted into a natural language utterance that can be converted into an electronic signal and provided to the user through a speaker coupled to the output device **114**, or the results may be visually presented on a display coupled to the output device **114**, or in any other suitable manner (e.g., the results may indicate whether a particular task or command was successfully performed, or the results may include information retrieved in response to one or more queries, or the results may include a request to frame a subsequent multi-modal interaction if the results are ambiguous or otherwise incomplete, etc.).

Furthermore, in one implementation, the conversational language processor **130** may include a misrecognition engine **132***e* configured to determine whether the conversational language processor **130** incorrectly determined the intent for the multi-modal interactions. In one implementation, the misrecognition engine **132***e* may determine that the conversational language processor **130** incorrectly determined the intent in response to one or more subsequent multi-modal interactions provided proximately in time to the prior multi-modal interactions, as described in U.S. patent application Ser. No. 11/200,164, entitled "System and Method of Supporting Adaptive Misrecognition in Conversational Speech," which issued as U.S. Pat. No. 7,620,549 on Nov. 17, 2009, the contents of which are hereby incorporated by reference in their entirety. For example, the misrecognition engine **132***e* may monitor for one or more subsequent multi-modal interactions that include a stop word, override a current request, or otherwise indicate an unrecognized or misrecognized event. The misrecognition engine **132***e* may then determine one or more tuning parameters for various components associated with the ASR **120** and/or the conversational language processor **130** to improve subsequent interpretations.

Accordingly, as described in further detail above, the voice-enabled device **100** may generally include various natural language processing components and capabilities that may be used for hybrid processing in the natural language voice services environment. In particular, the voice-enabled device **100** may be configured to determine the intent for various multi-modal interactions that include any suitable combination of natural language utterances and/or non-voice interactions and process one or more queries, tasks, commands, or other requests based on the determined intent. Furthermore, as noted above and as will be described in greater detail below, one or more other systems and/or multi-modal devices may participate in determining the intent and processing the queries, tasks, commands, or other requests for the multi-modal interactions to provide a hybrid processing methodology, wherein the voice-enabled device **100** and the various other systems and multi-modal devices may each perform partial processing to determine the intent and otherwise process the multi-modal interactions in a cooperative manner. For example, in one implementation, hybrid processing in the natural language voice services environment may include one or more techniques described in U.S. Provisional Patent Application Ser. No. 61/259,827, entitled "System and Method for Hybrid Processing in a Natural Language Voice Services Environment," filed on Nov. 10, 2009, the contents of which are hereby incorporated by reference in their entirety.

According to one aspect of the invention, FIG. **2** illustrates a block diagram of an exemplary system for hybrid processing in a natural language voice service environment. In particular, the system illustrated in FIG. **2** may generally include a voice-enabled client device **210** similar to the voice-enabled device described above in relation to FIG. **1**. For example, the voice-enabled client device **210** may include any suitable combination of input and output devices **215***a* respectively arranged to receive natural language multi-modal interactions and provide responses to the natural language multi-modal interactions. In addition, the voice-enabled client device **210** may include an Automatic Speech Recognizer (ASR) **220***a* configured to generate one or more preliminary interpretations of natural language utterances received at the input device **215***a*, and further configured to provide the preliminary interpretations to a conversational language processor **230***a*.

In one implementation, the conversational language processor **230***a* on the voice-enabled client device **210** may include one or more natural language processing components, which may be invoked to determine an intent for the multi-modal interactions received at the voice-enabled client device **210**. The conversational language processor **230***a* may then initiate one or more queries, tasks, commands, or other requests to resolve the determined intent. For example, the conversational language processor **230***a* may invoke one or more applications **234***a* to process requests in a particular domain, query one or more data repositories **236***a* to retrieve information requested in the multi-modal interactions, or otherwise engage in one or more cooperative conversations with a user of the voice-enabled client device **210** to resolve the determined intent. Furthermore, as noted above in connection with FIG. **1**, the voice-enabled client device **210** may also cooperate with one or more other systems or

multi-modal devices having suitable processing capabilities for initiating queries, tasks, commands, or other requests to resolve the intent of the multi-modal interactions.

In particular, to cooperate with the other systems or multi-modal devices in the hybrid processing environment, the voice-enabled client device **210** may use a messaging interface **250***a* to communicative with a virtual router **260**, wherein the messaging interface **250***a* may generally include a light client (or thin client) that provides a mechanism for the voice-enabled client device **210** to transmit input to and receive output from the virtual router **260**. In addition, the virtual router **260** may further include a messaging interface **250***b* providing a mechanism for communicating with one or more additional voice-enabled devices **270***a-n*, one or more non-voice devices **280***a-n*, and a voice-enabled server **240**. Furthermore, although FIG. **2** illustrates messaging interface **250***a* and messaging interface **250***b* as components that are distinct from the devices to which they are communicatively coupled, it will be apparent that such illustration is for ease of description only, as the messaging interfaces **250***a-b* may be provided as on-board components that execute on the various devices illustrated in FIG. **2** to facilitate communication among the various devices in the hybrid processing environment.

For example, in one implementation, the messaging interface **250***a* that executes on the voice-enabled client device **210** may transmit input from the voice-enabled client device **210** to the virtual router **260** within one or more XML messages, wherein the input may include encoded audio corresponding to natural language utterances, preliminary interpretations of the natural language utterances, data corresponding to multi-touch gestures, point of focus or attention focus selections, and/or other multi-modal interactions. In one implementation, the virtual router **260** may then further process the input using a conversational language processor **230***c* having capabilities for speech recognition, intent determination, adaptive misrecognition, and/or other natural language processing. Furthermore, the conversational language processor **230***c* may include knowledge relating to content, services, applications, natural language processing capabilities, and other features available through the various devices in the hybrid processing environment.

As such, in one implementation, the virtual router **260** may further communicate with the voice-enabled devices **270**, the non-voice devices **280**, and/or the voice-enabled server **240** through the messaging interface **250***b* to coordinate processing for the input received from the voice-enabled client device **210**. For example, based on the knowledge relating to the features and capabilities of the various devices in the hybrid processing environment, the virtual router **260** may identify one or more of the devices that have suitable features and/or capabilities for resolving the intent of the input received from the voice-enabled client device **210**. The virtual router **260** may then forward one or more components of the input to the identified devices through respective messaging interfaces **250***b*, wherein the identified devices may be invoked to perform any suitable processing for the components of the input forwarded from the virtual router **260**. In one implementation, the identified devices may then return any results of the processing to the virtual router **260** through the respective messaging interfaces **250***b*, wherein the virtual router **260** may collate the results of the processing and return the results to the voice-enabled client device **210** through the messaging interface **250***a*.

Accordingly, the virtual router **260** may communicate with any of the devices available in the hybrid processing environment through messaging interfaces **250***a-b* to coordinate cooperative hybrid processing for multi-modal interactions or other natural language inputs received from the voice-enabled client device **210**. For example, in one implementation, the cooperative hybrid processing may be used to enhance performance in embedded processing architectures in which the voice-enabled client device **210** includes a constrained amount of resources (e.g., the voice-enabled client device **210** may be a mobile device having a limited amount of internal memory or other dedicated resources for natural language processing). As such, when the voice-enabled client device **210** has an embedded processing architecture, one or more components of the voice-enabled client device **210** may be configured to optimize efficiency of on-board natural language processing to reduce or eliminate bottlenecks, lengthy response times, or degradations in performance.

For example, in one implementation, optimizing the efficiency of the on-board natural language processing may include configuring the ASR **220***a* to use a virtual dictation grammar having decoy words for out-of-vocabulary words, reduced vocabularies derived from a conversation history, or other dynamic recognition grammars (e.g., grammars optimized for particular languages, contexts, domains, memory constraints, and/or other suitable criteria). In another example, the on-board applications **234***a* and/or data repositories **236***a* may be associated with an embedded application suite providing particular features and capabilities for the voice-enabled client device **210**. For example, the voice-enabled client device **210** may be embedded within an automotive telematics system, a personal navigation device, a global positioning system, a mobile phone, or another device in which users often request location-based services. Thus, in such circumstances, the on-board applications **234***a* and the data repositories **236***a* in the embedded application suite may be optimized to provide certain location-based services that can be efficiently processed on-board (e.g., destination entry, navigation, map control, music search, hands-free dialing, etc.).

Furthermore, although the components of the voice-enabled client device **210** may be optimized for efficiency in embedded architectures, a user may nonetheless request any suitable content, services, applications, and/or other features available in the hybrid processing environment, and the other devices in the hybrid processing environment may collectively provide natural language processing capabilities to supplement the embedded natural language processing capabilities for the voice-enabled client device **210**. For example, the voice-enabled client device **210** may perform preliminary processing for a particular multi-modal interaction using the embedded natural language processing capabilities (e.g., the on-board ASR **220***a* may perform advanced virtual dictation to partially transcribe an utterance in the multi-modal interaction, the on-board conversational language processor **230***a* may determine a preliminary intent of the multi-modal interaction, etc.), wherein results of the preliminary processing may be provided to the virtual router **260** for further processing.

In one implementation, the voice-enabled client device **210** may also communicate input corresponding to the multi-modal interaction to the virtual router **260** in response to determining that on-board capabilities cannot suitably interpret the interaction (e.g., if a confidence level for a partial transcription does not satisfy a particular threshold), or in response to determining that the interaction should be processed off-board (e.g., if a preliminary interpretation indicates that the interaction relates to a local search request

requiring large computations to be performed on the voice-enabled server **240**). As such, the virtual router **260** may capture the input received from the voice-enabled client device **210** and coordinate further processing among the voice-enabled devices **270** and the voice-enabled server **240** that provide natural language processing capabilities in addition to the non-voice devices **280** that provide capabilities for retrieving data or executing tasks. Furthermore, in response to the virtual router **260** invoking one or more of the voice-enabled devices **270**, the input provided to the voice-enabled devices **270** may be optimized to suit the processing requested from the invoked voice-enabled devices **270** (e.g., to avoid over-taxing processing resources, a particular voice-enabled device **270** may be provided a partial transcription or a preliminary interpretation and resolve the intent for a given context or domain).

Alternatively, in response to the virtual router **260** invoking the voice-enabled server **240**, the input provided to the voice-enabled devices **270** may further include encoded audio corresponding to natural language utterances and any other data associated with the multi-modal interaction. In particular, as shown in FIG. **2**, the voice-enabled server **240** may have a natural language processing architecture similar to the voice-enabled client device **210**, except that the voice-enabled server **240** may include substantial processing resources that obviate constraints that the voice-enabled client device **210** may be subject to. Thus, when the voice-enabled server **240** cooperates in the hybrid processing for the multi-modal interaction, the encoded audio corresponding to the natural language utterances and the other data associated with the multi-modal interaction may be provided to the voice-enabled server **240** to maximize a likelihood of the voice-enabled server **240** correctly determining the intent of the multi-modal interaction (e.g., the ASR **220***b* may perform multi-pass speech recognition to generate an accurate transcription for the natural language utterance, the conversational language processor **230***b* may arbitrate among intent determinations performed in any number of different contexts or domains, etc.). Accordingly, in summary, the hybrid processing techniques performed in the environment illustrated in FIG. **2** may generally include various different devices, which may or may not include natural language capabilities, cooperatively determining the intent of a particular multi-modal interaction and taking action to resolve the intent.

Although the cooperative hybrid processing techniques described above have been particularly described in the context of an embedded processing architecture, such techniques are not necessarily limited to embedded processing architectures. In particular, the same techniques may be applied in any suitable voice services environment having various devices that can cooperate to initiate queries, tasks, commands, or other requests to resolve the intent of multi-modal interactions. Furthermore, in one implementation, the voice-enabled client device **210** may include a suitable amount of memory or other resources that can be dedicated to natural language processing (e.g., the voice-enabled client device **210** may be a desktop computer or other device that can process natural language without substantially degraded performance). In such circumstances, one or more of the components of the voice-enabled client device **210** may be configured to optimize the on-board natural language processing in a manner that could otherwise cause bottlenecks, lengthy response times, or degradations in performance in an embedded architecture. For example, in one implementation, optimizing the on-board natural language processing may include configuring the ASR **220***a* to use a large list dictation grammar in addition to and/or instead of the virtual dictation grammar used in embedded processing architectures.

Nonetheless, as will be described in greater detail below in connection with FIGS. **3-5**, the cooperative hybrid processing techniques may be substantially similar regardless of whether the voice-enabled client device **210** has an embedded or non-embedded architecture. In particular, regardless of the architecture for the voice-enabled client device **210**, cooperative hybrid processing may include the voice-enabled client device **210** optionally performing preliminary processing for a natural language multi-modal interaction and communicating input corresponding to the multi-modal interaction to the virtual router **260** for further processing through the messaging interface **250***a*. Alternatively (or additionally), the cooperative hybrid processing may include the virtual router **260** coordinating the further processing for the input among the various devices in the hybrid environment through messaging interface **250***b*, and subsequently returning any results of the processing to the voice-enabled client device **210** through messaging interface **250***a*.

According to various aspects of the invention, FIG. **3** illustrates a flow diagram of an exemplary method for initializing various devices that cooperate to perform hybrid processing in a natural language voice services environment. In particular, as noted above, the hybrid processing environment may generally include communication among various different devices that may cooperatively process natural language multi-modal interactions. For example, in one implementation, the various devices in the hybrid processing environment may include a virtual router having one or more messaging interfaces for communicating with one or more voice-enabled devices, one or more non-voice devices, and/or a voice-enabled server. As such, in one implementation, the method illustrated in FIG. **3** may be used to initialize communication in the hybrid processing environment to enable subsequent cooperative processing for one or more natural language multi-modal interactions received at any particular device in the hybrid processing environment.

In one implementation, the various devices in the hybrid processing environment may be configured to continually listen or otherwise monitor respective input devices to determine whether a natural language multi-modal interaction has occurred. As such, the method illustrated in FIG. **3** may be used to calibrate, synchronize, or otherwise initialize the various devices that continually listen for the natural language multi-modal interactions. For example, as described above in connection with FIG. **2**, the virtual router, the voice-enabled devices, the non-voice devices, the voice-enabled server, and/or other devices in the hybrid processing environment may be configured to provide various different capabilities or services, wherein the initialization method illustrated in FIG. **3** may be used to ensure that the hybrid processing environment obtains a suitable signal to process any particular natural language multi-modal interaction and appropriately invoke one or more of the devices to cooperatively process the natural language multi-modal interaction. Furthermore, the method illustrated in FIG. **3** and described herein may be invoked to register the various devices in the hybrid processing environment, register new devices added to the hybrid processing environment, publish domains, services, intent determination capabilities, and/or other features supported on the registered devices, synchronize local timing for the registered devices, and/or initialize any other suitable aspect of the devices in the hybrid processing environment.

In one implementation, initializing the various devices in the hybrid processing environment may include an operation **310**, wherein a device listener may be established for each of the devices in the hybrid processing environment. The device listeners established in operation **310** may generally include any suitable combination of instructions, firmware, or other routines that can be executed on the various devices to determine capabilities, features, supported domains, or other information associated with the devices. For example, in one implementation, the device listeners established in operation **310** may be configured to communicate with the respective devices using the Universal Plug and Play protocol designed for ancillary computer devices, although it will be apparent that any appropriate mechanism for communicating with the various devices may be suitably substituted.

In response to establishing the device listeners for each device registered in the hybrid processing environment (or in response to establishing device listeners for any device newly registered in the hybrid processing environment), the device listeners may then be synchronized in an operation **320**. In particular, each of the registered devices may have an internal clock or other timing mechanism that indicates local timing for an incoming natural language multi-modal interaction, wherein operation **320** may be used to synchronize the device listeners established in operation **310** according to the internal clocks or timing mechanisms for the respective devices. Thus, in one implementation, synchronizing the device listeners in operation **320** may include each device listener publishing information relating to the internal clock or local timing for the respective device. For example, the device listeners may publish the information relating to the internal clock or local timing to the virtual router, whereby the virtual router may subsequently coordinate cooperative hybrid processing for natural language multi-modal interactions received at one or more of the devices in the hybrid processing environment. It will be apparent, however, that the information relating to the internal clock or local timing for the various devices in the hybrid processing environment may be further published to the other voice-enabled devices, the other non-voice devices, the voice-enabled server, and/or any other suitable device that may participate in cooperative processing for natural language multi-modal interactions provided to the hybrid processing environment.

In one implementation, in response to establishing and synchronizing the device listeners for the various devices registered in the hybrid processing environment, the device listeners may continually listen or otherwise monitor respective devices on the respective registered devices in an operation **330** to detect information relating to one or more natural language multi-modal interactions. For example, the device listeners may be configured to detect occurrences of the natural language multi-modal interactions in response to detecting an incoming natural language utterance, a point of focus or attention focus selection associated with an incoming natural language utterance, and/or another interaction or sequence of interactions that relates to an incoming natural language multi-modal interaction. In addition, operation **330** may further include the appropriate device listeners capturing the natural language utterance and/or related non-voice device interactions that relate to the natural language utterance.

In one implementation, the captured natural language utterance and related non-voice device interactions may then be analyzed in an operation **340** to manage subsequent cooperative processing in the hybrid processing environment. In one implementation, for example, operation **340** may determine whether one device listener or multiple device listeners captured information relating to the natural language multi-modal interaction detected in operation **330**. In particular, as noted above, the hybrid processing environment may generally include various different devices that cooperate to process natural language multi-modal interactions, whereby the information relating to the natural language multi-modal interaction may be provided to one or a plurality of the devices in the hybrid processing environment. As such, operation **340** may determine whether one device listener or multiple device listeners captured the information relating to the natural language multi-modal interaction in order to determine whether the hybrid processing environment needs to synchronize signals among various device listeners that captured information relating to the multi-modal interaction.

For example, a user interacting with the hybrid processing environment may view a web page presented on a non-voice display device and provide a natural language multi-modal interaction that requests more information about purchasing a product displayed on the web page. The user may then select text on the web page containing the product name using a mouse, keyboard, or other non-voice input device and provide a natural language utterance to a microphone or other voice-enabled device such as "Is this available on Amazon.com?" In this example, a device listener associated with the non-voice display device may detect the text selection for the product name in operation **330**, and a device listener associated with the voice-enabled device may further detect the natural language utterance inquiring about the availability of the product in operation **330**. Furthermore, in one implementation, the user may be within a suitable range of multiple voice-enabled devices, which may result in multiple device listeners capturing different signals corresponding to the natural language utterance (e.g., the interaction may occur within range of a voice-enabled mobile phone, a voice-enabled telematics device, and/or other voice-enabled devices, depending on the arrangement and configuration of the various devices in the hybrid processing environment).

Accordingly, as will be described in greater detail herein, a sequence of operations that synchronizes different signals relating to the multi-modal interaction received at the multiple device listeners may be initiated in response to operation **340** determining that multiple device listeners captured information relating to the natural language multi-modal interaction. On the other hand, in response to operation **340** determining that only one device listener captured information relating to the natural language multi-modal interaction, the natural language multi-modal interaction may be processed in an operation **390** without executing the sequence of operations that synchronizes different signals (i.e., the one device listener provides all of the input information relating to the multi-modal interaction, such that hybrid processing for the interaction may be initiated in operation **390** without synchronizing different input signals). However, in one implementation, the sequence of synchronization operations may also be initiated in response to one device listener capturing a natural language utterance and one or more non-voice interactions to align different signals relating to the natural language multi-modal interaction, as described in greater detail herein.

As described above, each device listener that receives an input relating to the natural language multi-modal interaction detected in operation **330** may have an internal clock or other local timing mechanism. As such, in response to

determining that one or more device listeners captured different signals relating to the natural language multi-modal interaction in operation **340**, the sequence of synchronization operations for the different signals may be initiated in an operation **350**. In particular, operation **350** may include the one or more device listeners determining local timing information for the respective signals based on the internal clock or other local timing mechanism associated with the respective device listeners, wherein the local timing information determined for the respective signals may then be synchronized.

For example, in one implementation, synchronizing the local timing information for the respective signals may be initiated in an operation **360**. In particular, operation **360** may generally include notifying each device listener that received an input relating to the multi-modal interaction of the local timing information determined for each respective signal. For example, in one implementation, each device listener may provide local timing information for a respective signal to the virtual router, and the virtual router may then provide the local timing information for all of the signals to each device listener. As such, in one implementation, operation **360** may result in each device listener receiving a notification that includes local timing information for each of the different signals that relate to the natural language multi-modal interaction detected in operation **330**. Alternatively (or additionally), the virtual router may collect the local timing information for each of the different signals from each of the device listeners and further synchronize the local timing information for the different signals to enable hybrid processing for the natural language multi-modal interaction.

In one implementation, any particular natural language multi-modal interaction may include at least a natural language utterance, and may further include one or more additional device interactions relating to the natural language utterance. As noted above, the utterance may generally be received prior to, contemporaneously with, or subsequent to the additional device interactions. As such, the local timing information for the different signals may be synchronized in an operation **370** to enable hybrid processing for the natural language multi-modal interaction. In particular, operation **370** may include aligning the local timing information for one or more signals corresponding to the natural language utterance and/or one or more signals corresponding to any additional device interactions that relate to the natural language utterance. In addition, operation **370** may further include aligning the local timing information for the natural language utterance signals with the signals corresponding to the additional device interactions.

Thus, in matching the utterance signals and the non-voice device interaction signals, any devices that participate in the hybrid processing for the natural language multi-modal interaction may be provided with voice components and/or non-voice components that have been aligned with one another. For example, in one implementation, operation **370** may be executed on the virtual router, which may then provide the aligned timing information to any other device that may be invoked in the hybrid processing. Alternatively (or additionally), one or more of the other devices that participate in the hybrid processing may locally align the timing information (e.g., in response to the virtual router invoking the voice-enabled server in the hybrid processing, resources associated with the voice-enabled server may be employed to align the timing information and preserve communication bandwidth at the virtual router).

Furthermore, in one implementation, the virtual router and/or other devices in the hybrid processing environment may analyze the signals corresponding to the natural language utterance in an operation **380** to select the cleanest sample for further processing. In particular, as noted above, the virtual router may include a messaging interface for receiving an encoded audio sample corresponding to the natural language utterance from one or more of the voice-enabled devices. For example, the audio sample received at the virtual router may include the natural language utterance encoded in the MPEG-1 Audio Layer 3 (MP3) format or another lossy format to preserve communication bandwidth in the hybrid processing environment. However, it will be apparent that the audio sample may alternatively (or additionally) be encoded using the Free Lossless Audio Codec (FLAC) format or another lossless format in response to the hybrid processing environment having sufficient communication bandwidth for processing lossless audio that may provide a better sample of the natural language utterance.

Regardless of whether the audio sample has been encoded in a lossy or lossless format, the signal corresponding to the natural language utterance that provides the cleanest sample may be selected in operation **380**. For example, one voice-enabled device may be in a noisy environment or otherwise associated with conditions that interfere with generating a clean audio sample, while another voice-enabled device may include a microphone array or be configured to employ techniques that maximize fidelity of encoded speech. As such, in response to multiple signals corresponding to the natural language utterance being received in operation **330**, the cleanest signal may be selected in operation **380** and hybrid processing for the natural language utterance may then be initiated in an operation **390**.

Accordingly, the synchronization and initialization techniques illustrated in FIG. **3** and described herein may ensure that the hybrid processing environment synchronizes each of the signals corresponding to the natural language multi-modal interaction and generates an input for further processing in operation **390** most likely to result in a correct intent determination. Furthermore, in synchronizing the signals and selecting the cleanest audio sample for the further processing in operation **390**, the techniques illustrated in FIG. **3** and described herein may ensure that none of the devices in the hybrid processing environment take action on a natural language multi-modal interaction until the appropriate signals to be used in operation **390** have been identified. As such, hybrid processing for the natural language multi-modal interaction may be initiated in operation **390**, as described in further detail herein.

According to one aspect of the invention, FIG. **4** illustrates a flow diagram of am exemplary method for performing hybrid processing at one or more client devices in a natural language voice services environment. In particular, as will be described in greater below with reference to FIG. **5**, the one or more client devices may perform the hybrid processing in cooperation with a virtual router through a messaging interface that communicatively couples the client devices and the virtual router. For example, in one implementation, the messaging interface may generally include a light client (or thin client) that provides a mechanism for the client devices to transmit input relating to a natural language multi-modal interaction to the virtual router, and that further provides a mechanism for the client devices to receive output relating to the natural language multi-modal interaction from the virtual router.

For example, in one implementation, the hybrid processing at the client devices may be initiated in response to one

or more of the client devices receiving a natural language multi-modal interaction in an operation **410**. In particular, the natural language multi-modal interaction may generally include a natural language utterance received at a microphone or other voice-enabled input device coupled to the client device that received the natural language multi-modal interaction, and may further include one or more other additional input modalities that relate to the natural language utterance (e.g., text selections, button presses, multi-touch gestures, etc.). As such, the natural language multi-modal interaction received in operation **410** may include one or more queries, commands, or other requests provided to the client device, wherein the hybrid processing for the natural language multi-modal interaction may then be initiated in an operation **420**.

As described in greater detail above, the natural language voice services environment may generally include one or more voice-enabled client devices, one or more non-voice devices, a voice-enabled server, and a virtual router arranged to communicate with each of the voice-enabled client devices, the non-voice devices, and the voice-enabled server. In one implementation, the virtual router may therefore coordinate the hybrid processing for the natural language multi-modal interaction among the voice-enabled client devices, the non-voice devices, and the voice-enabled server. As such, the hybrid processing techniques described herein may generally refer to the virtual router coordinating cooperative processing for the natural language multi-modal interaction in a manner that involves resolving an intent of the natural language multi-modal interaction in multiple stages.

In particular, as described above in connection with FIG. **3**, the various devices that cooperate to perform the hybrid processing may be initialized to enable the cooperative processing for the natural language multi-modal interaction. As such, in one implementation, in response to initializing the various devices, each of the client devices that received an input relating to the natural language multi-modal interaction may perform initial processing for the respective input in an operation **420**. For example, in one implementation, a client device that received the natural language utterance included in the multi-modal interaction may perform initial processing in operation **420** that includes encoding an audio sample corresponding to the utterance, partially or completely transcribing the utterance, determining a preliminary intent for the utterance, or performing any other suitable preliminary processing for the utterance. In addition, the initial processing in operation **420** may also be performed at a client device that received one or more of the additional input modalities relating to the utterance. For example, the initial processing performed in operation **420** for the additional input modalities may include identifying selected text, selected points of focus or attention focus, or generating any other suitable data that can be used to further interpret the utterance. In one implementation, an operation **430** may then include determining whether the hybrid processing environment has been configured to automatically route inputs relating to the natural language multi-modal interaction to the virtual router.

For example, in one implementation, operation **430** may determine that automatic routing has been configured to occur in response to multiple client devices receiving the natural language utterance included in the multi-modal interaction in operation **410**. In this example, the initial processing performed in operation **420** may include the multiple client devices encoding respective audio samples corresponding to the utterance, wherein messages that include the encoded audio samples may then be sent to the virtual router in an operation **460**. The virtual router may then select one of the encoded audio samples that provides a cleanest signal and coordinate subsequent hybrid processing for the natural language multi-modal interaction, as will be described in greater detail below with reference to FIG. **5**. In another example, operation **430** may determine that automatic routing has been configured to occur in response to the initial processing resulting in a determination that the multi-modal interaction relates to a request that may be best suited for processing on the voice-enabled server (e.g., the request may relate to a location-based search query or another command or task that requires resources managed on the voice-enabled server, content, applications, domains, or other information that resides on one or more devices other than the client device that received the request, etc.). However, it will be apparent that the hybrid processing environment may be configured for automatic routing in response to other conditions and/or regardless of whether any attendant conditions exist, as appropriate.

In one implementation, in response to the virtual router coordinating the hybrid processing for the natural language multi-modal interaction, the virtual router may provide results of the hybrid processing to the client device in an operation **470**. For example, the results provided to the client device in operation **470** may include a final intent determination for the natural language multi-modal interaction, information requested in the interaction, data generated in response to executing a command or task requested in the interaction, and/or other results that enable the client device to complete processing for the natural language request in operation **480**. For example, in one implementation, operation **480** may include the client device executing a query, command, task, or other request based on the final intent determination returned from the virtual router, presenting the requested information returned from the virtual router, confirming that the requested command or task has been executed, and/or performing any additional processing to resolve the natural language request.

Referring back to operation **430**, in response to determining that the conditions that trigger automatic routing have not been satisfied or that automatic router has otherwise not been configured, the client device may further process the natural language multi-modal interaction in an operation **440**. In one implementation, the further processing in operation **440** may include the client device attempting to determine an intent for the natural language multi-modal interaction using local natural language processing capabilities. For example, the client device may merge any non-voice input modalities included in the multi-modal interaction a transcription for the utterance included in the multi-modal interaction. The conversational language processor on the client device may then determine the intent for the multi-modal interaction utilizing local information relating to context, domains, shared knowledge, criteria values, or other information. The client device may then generate one or more interpretations for the utterance to determine the intent for the multi-modal interaction (e.g., identifying a conversation type, one or more requests contained in the interactions, etc.).

In one implementation, operation **440** may further include determining a confidence level for the intent determination generated on the client device (e.g., the confidence level may be derived in response to whether the client devices includes a multi-pass speech recognition engine, whether the utterance contained any ambiguous words or phrases, whether the intent differs from one context to another, etc.). In one

implementation, an operation **450** may then determine whether or not to invoke off-board processing depending on the confidence level determined in operation **440**. For example, operation **450** may generally include determining whether the intent determined in operation **440** satisfies a particular threshold value that indicates an acceptable confidence level for taking action on the determined intent. As such, in response to the confidence level for the intent determination satisfying the threshold value, operation **450** may determine to not invoke off-board processing. In particular, the confidence level satisfying the threshold value may indicate that the client device has sufficient information to take action on the determined intent, whereby the client device may then process one or more queries, commands, tasks, or other requests to resolve the multi-modal interaction in operation **480**.

Alternatively, in response to the confidence level for the intent determination failing to satisfy the threshold value, operation **450** may invoke off-board processing, which may include sending one or more messages to the virtual router in operation **460**. The one or more messages may cause the virtual router to invoke additional hybrid processing for the multi-modal interaction in a similar manner as noted above, and as will be described in greater detail herein with reference to FIG. **5**.

According to one aspect of the invention, FIG. **5** illustrates a flow diagram of am exemplary method for performing hybrid processing at a virtual router in a natural language voice services environment. In particular, as the virtual router may coordinate the hybrid processing for natural language multi-modal interactions received at one or more client devices. In one implementation, in an operation **510**, the virtual router may receive one or more messages relating to a natural language multi-modal interaction received at one or more of the client devices in the voice services environment. For example, the virtual router may include a messaging interface that communicatively couples the virtual router to the client devices and a voice-enabled server, wherein the messaging interface may generally include a light client (or thin client) that provides a mechanism for the virtual router to receive input from one or more the client devices and/or the voice-enabled server, and further to transmit output to one or more the client devices and/or the voice-enabled server. The messages received in operation **510** may generally include any suitable processing results for the multi-modal interactions, whereby the virtual router may coordinate hybrid processing in a manner that includes multiple processing stages that may occur at the virtual router, one or more of the client devices, the voice-enabled server, or any suitable combination thereof.

In one implementation, the virtual router may analyze the messages received in operation **510** to determine whether to invoke the hybrid processing in a peer-to-peer mode. For example, one or more of the messages may include a preliminary intent determination that the virtual router can use to determine whether to invoke one or more of the client devices, the voice-enabled server, or various combinations thereof in order to execute one or more of the multiple processing stages for the multi-modal interaction. In another example, one or more of the messages may include an encoded audio sample that the virtual router forwards to one or more of the various devices in the hybrid processing environment. As such, in one implementation, the virtual router may analyze the messages received in operation **510** to determine whether or not to invoke the voice-enabled server to process the multi-modal interaction (e.g., the messages may include a preliminary intent determination that indicates that the multi-modal interaction includes a location-based request that requires resources residing on the server).

In response to the virtual router determining to invoke the voice-enabled server, the virtual router may forward the messages to the server in an operation **530**. In particular, the messages forwarded to the server may generally include the encoded audio corresponding to the natural language utterance and any additional information relating to other input modalities relevant to the utterance. For example, as described in greater detail above with reference to FIG. **2**, the voice-enabled server may include various natural language processing components that can suitably determine the intent of the multi-modal interaction, whereby the messages sent to the voice-enabled server may include the encoded audio in order to permit the voice-enabled server to determine the intent independently of any preliminary processing on the client devices that may be inaccurate or incomplete. In response to the voice-enabled server processing the messages received from the virtual router, results of the processing may then be returned to the virtual router in an operation **570**. For example, the results may include the intent determination for the natural language multi-modal interaction, results of any queries, commands, tasks, or other requests performed in response to the determined intent, or any other suitable results, as will be apparent.

Alternatively, in response to the virtual router determining to invoke the peer-to-peer mode in operation **520**, the virtual router may coordinate the hybrid processing among one or more the client devices, the voice-enabled server, or any suitable combination thereof. For example, in one implementation, the virtual router may determine a context for the natural language multi-modal interaction in an operation **540** and select one or more peer devices based on the determined context in an operation **550**. For example, one or more of the client devices may be configured to provide content and/or services in the determined context, whereby the virtual router may forward one or more messages to such devices in an operation **560** in order to request such content and/or services. In another example, the multi-modal interaction may include a compound request that relates to multiple contexts supported on different devices, whereby the virtual router may forward messages to each such device in operation **560** in order to request appropriate content and/or services in the different contexts.

In still another example, the interaction may include a request to be processed on the voice-enabled server, yet the request may require content and/or services that reside on one or more of the client devices (e.g., a location-based query relating to an entry in an address book on one or more of the client devices). As such, the virtual router may generally forward various messages to the selected peer devices in operation **560** to manage the multiple stages in the hybrid processing techniques described herein. For example, the virtual router may send messages to one or more voice-enabled client devices that have intent determination capabilities in a particular context, one or more non-voice client devices that have access to content, services, and/or other resources needed to process the multi-modal interaction, or any appropriate combination thereof. The virtual router may therefore send messages to the client devices and/or the voice-enabled server in operation **560** and receive responsive messages from the client devices and/or the voice-enabled server in operation **570** in any appropriate manner (e.g., in parallel, sequentially, iteratively, etc.). The virtual router may then collate the results received in the responsive messages in operation **580** and return the results

to one or more of the client devices for any final processing and/or presentation of the results.

According to one aspect of the invention, FIG. **6** illustrates a block diagram of an exemplary system for providing a natural language content dedication service. In particular, as shown in FIG. **6**, the system for providing the natural language content dedication service may generally include a voice-enabled client device **610** that can communicate with a content dedication system **665** through a messaging interface **665**. In one implementation, the voice-enabled client device **610** may communicate with the content dedication system **665** in a similar manner as described above with reference to FIGS. **2** through **5**. For example, the content dedication system **665** may include a virtual router **660** and a voice-enabled server **640** that can service multi-modal natural language requests provided to the voice-enabled client device **610** in a similar manner as described above, and may further include a billing system **638** that may be used to process transactions relating to the content dedication service. Further, although FIG. **6** illustrates the content dedication system **665** as including the virtual router **660**, the voice-enabled server **640**, and the billing system **638** within one component, such illustration will be understood to be for ease of description only, and that the virtual router **660**, the voice-enabled server **640**, and the billing system **638** may in fact be arranged within any number of components that can suitably communicate with one another to process multi-modal natural language requests relating to the content dedication service (e.g., the virtual router **660** may communicate with the voice-enabled server **640** through another messaging interface distinct from the messaging interface **650** for communicating with the voice-enabled client device **610**, as shown in the exemplary system illustrated in FIG. **2**).

In one implementation, the system shown in FIG. **6** may provide the natural language content dedication service to any suitable voice-enabled client device **610** having a suitable combination of input and output devices **615***a* that can receive natural language multi-modal interactions and provide responses to the natural language multi-modal interactions, wherein the input and output devices **615***a* may be further arranged to receive any other suitable type of input and provide any other suitable type of output. For example, in one implementation, the voice-enabled client device **610** may comprise a mobile phone that includes a keypad input device **615***a*, a touch screen input device **615***a*, or other input mechanisms **615***a* in addition to any input microphones or other suitable input devices **615***a* that can receive voice signals. As such, in this example, the mobile phone may further include an output display device **615***a* in addition to any output microphones or other suitable output devices **615***a* that can output audible signals. Thus, a user of the voice-enabled client device **610** may be listening to music, watching video, or otherwise interacting with content through the input and output devices **615***a* and provide a multi-modal natural language request to engage in a transaction to dedicate the music, video, or other content, as will be described in greater detail below. Furthermore, in one implementation, the voice-enabled client device **610** may be included within a hybrid processing environment that may include a plurality of different devices, whereby the content dedication request may relate to content played on a different device from the voice-enabled client device **610**, although the content dedication request may relate to any suitable content (i.e., the request need not necessarily relate to played content, as users may provide natural language to request content dedications for any suitable content).

Thus, in one implementation, in response to the voice-enabled client device **710** receiving a multi-modal interaction that includes a natural language utterance, the voice-enabled client device **610** may invoke an Automatic Speech Recognizer (ASR) **620***a* to generate one or more preliminary interpretations of the utterance. The ASR **620***a* may then provide the preliminary interpretations to a conversational language processor **630***a*, which may attempt to determine an intent for the multi-modal interaction. In one implementation, to determine the intent for the multi-modal interaction, the conversational language processor **630***a* may determine a most likely context for the interaction from the preliminary interpretations of the utterance, any accompanying non-speech inputs in the multi-modal interaction that relate to the utterance, contexts associated with prior requests, short-term and long-term shared knowledge, or any other suitable information for interpreting the multi-modal interaction. Thus, in response to the conversational language processor **630***a* determining that the intent for the multi-modal interaction relates to a content dedication request, a content dedication application **634***a* may be invoked to resolve the content dedication request.

For example, in one implementation, an initial multi-modal interaction may include the utterance "Find 'Superstylin'' by Groove Armada." In response to the initial multi-modal interaction, the ASR **620***a* may generate a preliminary interpretation that includes the words "Find" and "Superstylin" and the phrase "Groove Armada." The ASR **620***a* may then provide the preliminary interpretation to the conversational language processor **630***a*, which may determine that the word "Find" indicates that the most likely intent of the interaction includes a search, while the word "Superstylin" and the phrase "Groove Armada" provide criteria for the search. Furthermore, in response to determining the most likely intent of the interaction, the conversational language processor **630***a* may establish a music context for the interaction and attempt to resolve the search request. For example, the conversational language processor **630***a* may search one or more data repositories **636***a* that contain music information to identify music having a song title of "Superstylin" and an artist name of "Groove Armada," and the conversational language processor **630***a* may further cooperate with other devices in the hybrid processing environment to search for the song (e.g., in response to the local data repositories **636***a* not yielding adequate results, another device in the environment having a larger music data repository than the client device **610** may be invoked). The conversational language processor **630***a* may then receive appropriate results for the search and present the results to the user through the output device **615***a* (e.g., displaying information about the song, playing a sample audio clip of the song, displaying options to purchase the song, recommending similar songs or similar artists, etc.).

Continuing with the above example, a subsequent multi-modal interaction may include the utterance "Share this with my wife," "Dedicate it to Charlene," "That's the one, I want to pass along to some friends," or another suitable utterance that reflects a request to dedicate the content. Alternatively (or additionally), in response to the intent of the initial interaction including a request to search for content, the conversational language processor **630***a* may invoke the content dedication application **634***a*, which may present an option to dedicate the content through the output device **615***a* together with the results of the search. As such, the request to dedicate the content may also be provided in a non-speech input, such as a button press or touch screen

selection of the option to dedicate the content. Accordingly, in response to detecting a content dedication request (e.g., through the ASR **620***a* and the conversational language processor **630***a* processing a suitable utterance, the input device **615***a* receiving a suitable non-speech input, or any suitable combination thereof), the content dedication application **634***a* may be invoked to process the content dedication request.

In one implementation, to process the content dedication request, the content dedication application **634***a* may capture a natural language utterance that contains the dedication. For example, the content dedication application **634***a* may provide a prompt through the output device **615***a* that instructs the user to provide the dedication utterance (e.g., a visual or audible prompt instructing the user to begin speaking, to speak after an audible beep, etc.). The user may then provide the dedication utterance through the voice-enabled input device **615***a*, and the dedication utterance may then be converted into an electronic signal that the content dedication application **634***a* captures for the dedication (e.g., "Dear Charlene, I was listening to this song and I thought of you. Enjoy!"). In addition, the content dedication application **634***a* may further prompt the user to provide any additional tags for the dedicated content (e.g., an image or a picture to be inserted as album art for the dedicated content, a natural language utterance that includes information to be inserted as voice-tags for the dedicated content, a non-speech input or data input that includes information to insert in tags for the dedicated content, etc.). The content dedication application **634***a* may then prompt the user to identify a recipient **690** of the dedication, wherein the user may provide any suitable multi-modal input that includes an e-mail address, a telephone number, an address book entry, or other information identifying the recipient **690** of the dedication.

In one implementation, the content dedication application **634***a* may then route the request, including the dedication utterance, the additional tags (if any), and the information identifying the recipient **690** to the content dedication system **665** through the messaging interface **650**. For example, the dedication utterance may be converted into encoded audio that can be communicated through the messaging interface **650**, whereby the content dedication system **665** can insert the encoded audio corresponding to the dedication utterance within the dedicated content and/or verbally annotate the dedicated content with the encoded audio. Alternatively (or additionally), the dedication utterance may be interpreted and parsed to transcribe one or more words or phrases from the dedication utterance, wherein the transcribed words or phrases may provide a textual annotation for the dedicated content (e.g., the textual annotation may be inserted within metadata for the dedicated content, such as an ID3 Comments tag). Similarly, any utterances to be inserted as voice-tags for the dedicated content may provide further verbal annotations for the dedicated content, or such utterances may be transcribed to provide further textual annotations for the dedicated content. In one implementation, verbal annotations, textual annotations, and other types of annotations may be created and associated with the dedicated content using techniques described in co-pending U.S. patent application Ser. No. 11/212,693, entitled "Mobile Systems and Methods of Supporting Natural Language Human-Machine Interactions," filed Aug. 29, 2005, the contents of which are hereby incorporated by reference in their entirety.

In one implementation, in response to the content dedication system **665** receiving the content dedication request, the dedication utterance, and any additional tags from the content dedication application **634***a*, the content dedication system **665** may invoke a similar content dedication application **634***b* on the voice-enabled server **640** to process the request. In particular, the content dedication application **634***b* on the voice-enabled server **640** may identify the content requested for dedication and initiate a transaction for the content requested for dedication. For example, in one implementation, if the content dedication application **634***a* on the voice-enabled client device **610** was able to identify the requested content, the content dedication request received at the content dedication system **665** may include an identification of the content to be dedicated. Alternatively, because the content dedication system **665** can cooperate in resolving the multi-modal interactions involved in the dedication request, the content dedication system **665** may use shared knowledge relating to the dedication request to identify the content to be dedicated. For example, the content dedication system **665** may invoke one or more local natural language processing components (e.g., ASR **620***b*, conversational language processor **630***b* or **630***c*, etc.), search one or more local data repositories **636***b*, interact with one or more content providers **680** over a network **670**, pull data from a satellite radio system that played the requested content at the voice-enabled client device **610** or another device in the hybrid processing environment, or otherwise consult available resources that can be used to identify the content to be dedicated.

In one implementation, in response to identifying the content to be dedicated, the content dedication system **665** may communicate with a billing system **638** to identify one or more purchase options for the dedication request and process an appropriate transaction for the dedication request. In particular, the content dedication system **665** may generally support various different purchase options to provide users with flexibility in the manner of requesting content dedications, including a buy-to-own purchase option, a pay-to-play purchase option, a paid subscription purchase option, or other appropriate options. In one implementation, the purchase options may be modeled on techniques for providing natural language services and subscriptions described in U.S. patent application Ser. No. 10/452,147, entitled "Systems and Methods for Responding to Natural Language Speech Utterance," which issued as U.S. Pat. No. 7,398,209 on Jul. 8, 2008, and co-pending U.S. patent application Ser. No. 10/618,633, entitled "Mobile Systems and Methods for Responding to Natural Language Speech Utterance," filed Jun. 15, 2003, the contents of which are hereby incorporated by reference in their entirety. For example, in the buy-to-own purchase option, the content dedication system **665** may purchase full rights to the content from an appropriate content provider **680**, wherein the billing system **638** may then charge the user of the voice-enabled client device **610** a particular amount that encompasses the cost for purchasing the content from the content provider **680** plus a service charge for dedicating the content, tagging the dedicated content, delivering the dedicated content to the recipient **690**, or any other appropriate services rendered for the content dedication request. The billing system **638** may charge the user in a similar manner under the pay-to-play purchase option, except that the rights purchased from the content provider **680** may be limited to a single play, such that the cost for purchasing the content from the content provider **680** may be somewhat less under the pay-to-play purchase option.

Under the paid subscription purchase option, however, the user may pay a periodic service charge to the content dedication system **665** that permits the user to make a

predetermined number of content dedications or an unlimited number of content dedications in a subscription period, or the subscription purchase option may permit the user to make content dedications in any other suitable manner (e.g., different subscription levels having different content dedication options may be offered, such that the user may select a subscription level that meets the user's particular needs). For example, under the paid subscription purchase option, the billing system **638** may only charge the user any costs for obtaining the rights to the content, which may be purchased under either the buy-to-own option or the pay-to-play option, or alternatively the user may be charged nothing if the user already owns the dedication content. In another example, a first subscription level may cost a first amount to permit the user to make a particular number of content dedications in a subscription period, while a second subscription level may cost a higher amount to permit the user to make an unlimited number of content dedications in the subscription period, while still other subscription levels having different terms may be offered, as will be apparent.

Furthermore, in one implementation, a service provider associated with the content dedication system **665** may negotiate an agreement with the content provider **680** to determine the manner in which revenues for content transactions will be shared between the content dedication system **665** and the content provider **680**. For example, the agreement may provide that the content provider **680** may keep all of the revenue for transactions that include purchasing content from the content provider **680** and that the service provider associated with the content dedication system **665** may recoup costs for such transactions from users. In another example, the agreement may provide that the content provider **680** and the service provider associated with the content dedication system **665** may share the revenue for the transactions that include purchasing content from the content provider **680**. Thus, the agreement may generally include any suitable arrangement that defines the manner in which the content provider **680** and the service provider associated with the content dedication system **665** manage the revenue for the transactions that include purchasing content from the content provider **680**, while the service provider associated with the content dedication system **665** may manage billing users for the natural language aspects of the content dedication service according to the techniques described in further detail above.

According to one aspect of the invention, FIG. **7** illustrates a flow diagram of an exemplary method for providing a natural language content dedication service. In particular, the method for providing a natural language content dedication service, as shown in FIG. **7**, may be performed on a voice-enabled client device that can communicate with a content dedication system through a messaging interface, wherein the voice-enabled client device may communicate with the content dedication system in a similar manner as described above with reference to FIGS. **2** through **6**. For example, the content dedication system may include a virtual router and a voice-enabled server that can service multi-modal natural language requests provided to the voice-enabled client device, and may further include a billing system for processing transactions relating to the content dedication service.

In one implementation, the method shown in FIG. **7** may be used to provide the natural language content dedication service to any suitable voice-enabled client device having a suitable combination of input and output devices that can receive natural language multi-modal interactions and provide responses to the natural language multi-modal interactions, wherein the input and output devices may be further arranged to receive any other suitable type of input and provide any other suitable type of output. For example, in one implementation, the voice-enabled client device may comprise a mobile phone that includes a keypad input device, a touch screen input device, or other input mechanisms in addition to any input microphones or other suitable input devices that can receive voice signals, and may further include an output display device in addition to any output microphones or other suitable output devices that can output audible signals. Thus, a user of the voice-enabled client device may be listening to music, watching video, or otherwise interacting with content through the input and output devices, wherein an operation **710** may include the voice-enabled client device receiving a multi-modal natural language interaction to engage in a transaction to dedicate the music, video, or other content.

Thus, in one implementation, in response to the voice-enabled client device receiving the multi-modal interaction in operation **710** that includes a natural language utterance, the voice-enabled client device may invoke an Automatic Speech Recognizer (ASR) to generate one or more preliminary interpretations of the utterance. The ASR may then provide the preliminary interpretations to a conversational language processor, which may attempt to determine an intent for the multi-modal interaction. In one implementation, to determine the intent for the multi-modal interaction, the conversational language processor may determine a most likely context for the interaction from the preliminary interpretations of the utterance, any accompanying non-speech inputs in the multi-modal interaction that relate to the utterance, contexts associated with prior requests, short-term and long-term shared knowledge, or any other suitable information for interpreting the multi-modal interaction. Thus, in one implementation, an operation **720** may include the conversational language processor detecting a content dedication request in response to determining that the intent for the multi-modal interaction relates to a content dedication request. The conversational language processor may then invoke a content dedication application to resolve the content dedication request.

For example, in one implementation, the multi-modal interaction received in operation **720** may include the utterance "Buy that song and send it to Michael." In response to the initial multi-modal interaction, the ASR may generate a preliminary interpretation that includes words and/or phrases such as "Buy," "that song," "send it," and "to Michael." The ASR may then provide the preliminary interpretation to the conversational language processor, which may determine that the word and/or phrase combination of "Buy" and "send it" indicates that the most likely intent of the interaction includes a content dedication request, while the word and/or phrase combination of "that song" and "to Michael" provide criteria for the intended content and recipient for the dedication. Furthermore, in response to determining the most likely intent of the interaction, the conversational language processor may establish a device context, a dedication context, a content or music context, an address book context, or other suitable contexts in an attempt to resolve the request.

For example, the device context may enable the conversational language processor to retrieve data from the voice-enabled client device or another suitable device that provides the user's intended meaning for the phrase "that song" (e.g., the user may be referring to a song playing on the user's satellite radio device, such that the conversational language processor can identify the song that was playing

when the device interaction was received in operation **710**). Furthermore, the address book context may enable the conversational language processor to identify "Michael," the intended recipient of the dedication request. The conversational language processor may then receive appropriate results for resolving the intent of the request and present the results to the user through the output device (e.g., displaying information requesting that the user confirm that the content and recipient was correctly identified, playing a sample audio clip of the song, displaying options to purchase the song, recommending similar songs or similar artists, etc.). Accordingly, in response to detecting the content dedication request in operation **720** and identifying the relevant criteria identifying the content to be dedicated and the intended recipient, the content dedication application may be invoked to process the content dedication request.

For example, in one implementation, processing the content dedication request may include the content dedication application capturing a natural language utterance that contains the dedication for the requested content in an operation **730**. For example, the content dedication application may provide a prompt through the output device that instructs the user to provide the dedication utterance (e.g., a visual or audible prompt instructing the user to begin speaking, to speak after an audible beep, etc.). The user may then provide the dedication utterance through the voice-enabled input device, and the dedication utterance may then be converted into an electronic signal that the content dedication application captures in operation **730**. In addition, an operation **740** may include the content dedication application further prompting the user to provide any additional tags for the dedicated content (e.g., an image or a picture to be inserted as album art for the dedicated content, one or more natural language utterances to insert as voice-tags for the dedicated content, one or more natural language utterances to be transcribed into text that can be inserted in tags for the dedicated content, a non-speech input or data input that include information to insert in tags for the dedicated content, etc.).

Thus, in response to determining that the user has provided additional information to insert in tags for the dedication content in operation **740**, the content dedication application may then capture the tags in an operation **750**. For example, operation **750** may include the content dedication application capturing an image or picture that the user identifies for album art to be inserted in the dedicated content, capturing any natural language utterances to insert as voice-tags for the dedicated content, communicating with the ASR and/or conversational language processor to transcribe any natural language utterances to be inserted as text within tags for the dedicated content, capturing any non-speech inputs or data inputs that include information to insert as text within the tags for the dedicated content, or otherwise capturing information that relates to the additional tags.

In one implementation, the content dedication application may then process the content dedication request in an operation **760**, which may include prompting the user to identify the recipient of the dedication. For example, the content dedication application may request information identifying the recipient of the dedication in response to the user not having already identified the recipient, in response to the user identifying the recipient in a manner that includes ambiguity or other criteria that cannot be resolved without further information, to distinguish among different contact information known for the recipient, or in response to other appropriate circumstances. Thus, the user may provide any suitable multi-modal input that includes an e-mail address, a telephone number, an address book entry, or other criteria that can be used to uniquely identify the information for contacting the recipient of the dedication. Furthermore, in one implementation, processing the content dedication request in operation **760** may further include the content dedication application routing the request, including the dedication utterance, the additional tags (if any), and the information for contacting the recipient to the content dedication system through the messaging interface, wherein the content dedication system may then process a transaction for the content dedication request, as will be described in greater detail below.

According to one aspect of the invention, FIG. **8** illustrates a flow diagram of an exemplary method for providing a natural language content dedication service. In particular, the method for providing a natural language content dedication service, as shown in FIG. **8**, may include an operation **810** in which a content dedication system may receive a natural language content dedication request through a messaging interface. For example, in one implementation, the content dedication system may receive the natural language content dedication request from a content dedication application that executes on a voice-enabled client device. In one implementation, the natural language content dedication request received in operation **810** may generally include a natural language dedication utterance, information to be inserted within one or more tags for content to be dedicated, and information identifying a recipient of the dedicated content.

For example, in one implementation, the dedication utterance received in operation **810** may include encoded audio that the content dedication system can insert within the dedicated content or use to verbally annotate the dedicated content. Alternatively (or additionally), the content dedication system may interpret and parse the dedication utterance to transcribe one or more words or phrases from the dedication utterance, wherein the transcribed words or phrases may provide a textual annotation for the dedicated content (e.g., the textual annotation may be inserted within metadata for the dedicated content, such as an ID3 Comments tag). Similarly, any utterances to be inserted as voice-tags for the dedicated content may provide further verbal annotations for the dedicated content, or such utterances may be transcribed to provide further textual annotations for the dedicated content. In one implementation, verbal annotations, textual annotations, and other types of annotations may be created and associated with the dedicated content using techniques described in co-pending U.S. patent application Ser. No. 11/212,693, entitled "Mobile Systems and Methods of Supporting Natural Language Human-Machine Interactions," filed Aug. 29, 2005, the contents of which are hereby incorporated by reference in their entirety.

In one implementation, in response to the content dedication system receiving the content dedication request, the dedication utterance, and any additional tags from the content dedication application in operation **810**, the content dedication system may invoke a content dedication application on a voice-enabled server to process the content dedication request. In particular, an operation **820** may include the content dedication application on the voice-enabled server identifying the content requested for dedication. In one implementation, the request received from the content dedication application in operation **810** may include information identifying the requested content and/or information that the content dedication system can use to identify the requested content. For example, the request may include

a multi-modal natural language input that includes a natural language utterance and/or a non-voice input, wherein the content dedication system may use shared knowledge relating to the dedication request to identify the content to be dedicated.

Thus, operation **820** may include the content dedication system invoking one or more natural language processing components (e.g., an ASR, a conversational language processor, etc.), searching one or more data repositories, interacting with one or more content providers, pulling data from a satellite radio system that played the requested content at the voice-enabled client device or another device in a hybrid processing environment, or otherwise consulting available resources that can be used to identify the content to be dedicated. For example, in one implementation, the hybrid processing environment may include a device having an application that can identify played content (e.g., a Shazam® listening device that a user can hold near a speaker to identify content playing through the speaker). Thus, operation **820** may generally include the content dedication system communicating with any suitable device, system, application, or other resource to identify the content requested for dedication.

In one implementation, in response to identifying the content to be dedicated, an operation **830** may include the content dedication system identifying one or more purchase options for the dedication request. In one implementation, operation **830** may include the content dedication system communicating with a billing system that supports various purchase options to provide users with flexibility in the manner of requesting content dedications. For example, the billing system may support content dedication purchase options that include a buy-to-own purchase option, a pay-to-play purchase option, a paid subscription purchase option, or other appropriate options. In response to identifying the purchase option for the content dedication request, an operation **840** may include the content dedication system processing a transaction for the content identified in operation **820**.

For example, in response to operation **830** indicating that the user has selected the buy-to-own purchase option, the transaction processed in operation **840** may include purchasing full rights to the requested content from an appropriate content provider, wherein the billing system may then charge the user of the voice-enabled client device an appropriate amount that includes costs for purchasing the content from the content provider, adding the natural language utterance dedicating the content, tagging the dedicated content, delivering the dedicated content to the recipient, or any other appropriate services rendered for the content dedication request. Alternatively, in response to operation **830** indicating that the user has selected the pay-to-play purchase option, the transaction processed in operation **840** may include purchasing rights from the content provider that permits the purchased content to be played a predetermined number of times, wherein the billing system may charge the user in a similar manner as described above, except that the cost for purchasing limited rights to the content under the pay-to-play purchase option may be somewhat less than the cost for purchasing ownership rights to the content, as in the buy-to-own purchase option.

In another alternative implementation, in response to determining that the requested content dedication includes a selection of the paid subscription purchase option, the user may pay a periodic service charge to the content dedication system that permits the user to make a predetermined number of content dedications in a subscription period, an unlimited number of content dedications in the subscription period, or otherwise make content dedications in accordance with terms defined in a subscription (e.g., different subscription levels having different content dedication options may be offered, such as a subscription level that only permits utterance dedications, another subscription level that further permits interpreting and parsing utterance dedications, etc.). Thus, the content transaction may be processed in operation **840** according to the purchase options identified in operation **830**, and the content dedication system may then further process the dedication request to customize the dedicated content according to criteria provided in the request previously received in operation **810**.

For example, in one implementation, an operation **850** may include the content dedication system inserting the natural language dedication utterance into the dedicated content, verbally annotating the dedicated content with the dedication utterance, or otherwise associating the dedicated content with the dedication utterance. Furthermore, an operation **860** may include the content dedication system determining whether any additional tags have been specified for the dedicated content. For example, as noted above, the dedication request may identify an image or picture to insert as album art for the dedicated content, one or more natural language utterances, non-voice, and/or data inputs to be transcribed into text that can be inserted in tags for the dedicated content, or any other suitable information that can be inserted within or associated with metadata for the dedicated content. Thus, in response to determining that information for any additional tags has been provided, an operation **870** may include inserting such additional tags into the dedicated content.

In one implementation, in response to having purchased the content requested for dedication, associating the dedication utterance with the dedicated content, and associating the additional tags (if any) with the dedicated content, the content dedication system may send a content dedication message to the recipient of the dedication in an operation **880**. For example, the content dedication message may include a Short Message Service (SMS) text message, an electronic mail message, an automated telephone call managed by a text-to-speech engine, or any other appropriate message that can be appropriately delivered to the recipient (e.g., the message may include a link that the recipient can select to stream, download, or otherwise access the dedicated content, the dedication utterance, etc.). Thus, the content dedication message may generally notify the recipient that content has been dedicated to the recipient and provide various mechanisms for the recipient to access the content dedication, as will be apparent.

Implementations of the invention may be made in hardware, firmware, software, or various combinations thereof. The invention may also be implemented as instructions stored on a machine-readable medium, which may be read and executed by one or more processors. A machine-readable medium may include various mechanisms for storing or transmitting information in a form readable by a machine (e.g., a computing device). For example, a machine-readable storage medium may include read only memory, random access memory, magnetic disk storage media, optical storage media, flash memory devices, or other storage media, and a machine-readable transmission media may include forms of propagated signals, such as carrier waves, infrared signals, digital signals, or other transmission media. Further, firmware, software, routines, or instructions may be described in the above disclosure in terms of specific exemplary aspects and implementations of the invention, and performing cer-

tain actions. However, it will be apparent that such descriptions are merely for convenience, and that such actions in fact result from computing devices, processors, controllers, or other devices executing the firmware, software, routines, or instructions.

Accordingly, aspects and implementations of the invention may be described herein as including a particular feature, structure, or characteristic, but it will be apparent that every aspect or implementation may or may not necessarily include the particular feature, structure, or characteristic. In addition, when a particular feature, structure, or characteristic has been described in connection with a given aspect or implementation, it will be understood that such feature, structure, or characteristic may be included in connection with other aspects or implementations, whether or not explicitly described. Thus, various changes and modifications may be made to the preceding description without departing from the scope or spirit of the invention, and the specification and drawings should therefore be regarded as exemplary only, with the scope of the invention determined solely by the appended claims.

What is claimed is:

1. A system for providing a natural language content dedication service, comprising:

one or more processors; and

one or more non-transitory computer readable mediums storing executable instructions that when executed by the one or more processors cause the one or more processors to:

receive a first utterance that includes a natural language utterance;

determine, based on processing of the first utterance by a speech recognition engine, one or more words or phrases of the first utterance;

provide the one or more words or phrases as an input to a conversational language processor;

interpret the first utterance, at the conversational language processor, based on the one or more words or phrases;

identify, based on the interpretation of the first utterance, content to dedicate to a recipient;

initiate, based on the identified content, a dedication to the recipient;

receive a second utterance to be associated with the dedication;

determine, based on a processing of the second utterance by the speech recognition engine, one or more words or phrases of the second utterance;

provide the one or more words or phrases of the second utterance as textual annotations within metadata of the content; and

send information to enable the recipient to access the content and the second utterance.

2. The system of claim **1**, wherein the executable instructions, when executed by the one or more processors, cause the one or more processors to provide an image as one or more tags within metadata of the content.

3. The system of claim **1**, wherein the executable instructions, when executed by the one or more processors, cause the one or more processors to annotate the content with the second utterance.

4. The system of claim **1**, wherein the executable instructions, when executed by the one or more processors, cause the one or more processors to purchase the content from a content provider to enable the recipient to access the content.

5. The system of claim **4**, wherein the executable instructions, when executed by the one or more processors, cause the one or more processors to:

identify, for the dedication, a purchase option that includes one or more of a buy-to-own purchase option, a pay-to-play purchase option, or a paid subscription purchase option; and

bill a user associated with the first utterance based on the purchase option.

6. The system of claim **1**, wherein the executable instructions, when executed by the one or more processors, cause the one or more processors to: send, to the recipient, an electronic link to access the content as the information to enable the recipient to access the content; and

send, to the recipient, the second utterance in an encoded audio format as the information to enable the recipient to access the second utterance.

7. The system of claim **1**, wherein the content includes one or more of a song or a video.

8. A method for providing a natural language content dedication service, the method being implemented in a computer system having one or more processors programmed with computer program instructions that, when executed by the one or more processors, cause the computer system to perform the method, the method comprising:

receiving, by one or more processors, a first utterance that includes a natural language utterance;

determining, by the one or more processors, one or more words or phrases of the first utterance based on processing of the first utterance by a speech recognition engine;

providing, by the one or more processors, the one or more words or phrases as an input to a conversational language processor;

interpreting, by the one or more processors, the first utterance, at the conversational language processor, based on the one or more words or phrases;

identifying, by the one or more processors, content to dedicate to a recipient based on the interpretation of the first utterance;

initiating, by the one or more processors, a dedication to the recipient based on the identified content;

receiving, by the one or more processors, a second utterance to be associated with the dedication;

determining, by the one or more processors, one or more words or phrases of the second utterance based on a processing of the second utterance by the speech recognition engine;

providing, by the one or more processors, the one or more words or phrases of the second utterance as textual annotations within metadata of the content; and

sending, by the one or more processors, information to enable the recipient to access the content and the second utterance.

9. The method of claim **8**, further comprising providing an image as one or more tags within metadata of the content.

10. The method of claim **8**, further comprising annotating the content with the second utterance.

11. The method of claim **8**, further comprising purchasing the content from a content provider to enable the recipient to access the content.

12. The method of claim **11**, further comprising:

identifying, for the dedication, a purchase option that includes one or more of a buy-to-own purchase option, a pay-to-play purchase option, or a paid subscription purchase option; and

billing a user associated with the first utterance based on the purchase option.

13. The method of claim **8**, further comprising: sending, to the recipient, an electronic link to access the content as the information to enable the recipient to access the content; and

sending, to the recipient, the second utterance in an encoded audio format as the information to enable the recipient to access the second utterance.

14. The method of claim **8**, wherein the content includes one or more of a song or a video.

15. The system of claim **1**, wherein the executable instructions, when executed by the one or more processors, cause the one or more processors to:

determine that a user is interacting with a media item; and

identify, based on the natural language processing and the interaction of the user with the media item, the media item as the content to dedicate to the recipient.

16. The system of claim **1**, wherein the executable instructions, when executed by the one or more processors, cause the one or more processors to:

determine a media item that a user is playing;

determine that the user provided the first utterance during the playing of the media item by the user; and

identify, based on the natural language processing and the determination that the user provided the first utterance during the playing of the media item, the media item as the content to dedicate to the recipient.

17. The system of claim **1**, wherein the executable instructions, when executed by the one or more processors, cause the one or more processors to provide an electronic link associated with the content as one or more tags within metadata of the content.

18. The system of claim **1**, wherein the executable instructions, when executed by the one or more processors, cause the one or more processors to provide a voice tag as one or more tags within metadata of the content.

19. The system of claim **1**, wherein the executable instructions, when executed by the one or more processors, cause the one or more processors to provide the second utterance within the content.

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