

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
4 May 2006 (04.05.2006)

PCT

(10) International Publication Number
WO 2006/047297 A3

(51) International Patent Classification:
B60W 50/02 (2006.01) B60W 40/02 (2006.01)
B60W 50/08 (2006.01) G05D 1/02 (2006.01)

(21) International Application Number:
PCT/US2005/037918

(22) International Filing Date: 21 October 2005 (21.10.2005)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
10/972,082 22 October 2004 (22.10.2004) US
10/971,724 22 October 2004 (22.10.2004) US
10/971,725 22 October 2004 (22.10.2004) US
10/972,081 22 October 2004 (22.10.2004) US
10/971,718 22 October 2004 (22.10.2004) US

(71) Applicant (for all designated States except US): **IROBOT CORPORATION** [US/US]; 63 South Avenue, Burlington, MA 01803-4903 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **ALLARD, James, R.** [US/US]; 300 Hartman Road, Newton, MA 02159 (US). **BARRETT, David, S.** [US/US]; 18 Glenwood Drive, Needham, MA 02192 (US). **FILIPPOV, Mikhail** [RU/US]; 276 Highland Avenue, Arlington, MA 02476 (US). **PACK, Robert, Todd** [US/US]; 27 Vieckis Drive, Nashua, NH 03062 (US). **SVENDSEN, Selma** [BA/US]; 7 Cameron Road, Andover, MA 01810 (US).

(74) Agents: **JAGENOW, Andrew, L.** et al.; Goodwin Procter LLP, Exchange Place, Boston, MA 02109 (US).

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

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

Published:

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

(88) Date of publication of the international search report:
28 September 2006

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: SYSTEMS AND METHODS FOR CONTROL OF A VEHICLE

(57) Abstract: Systems and methods for autonomous control of a vehicle include interruptible, behavior-based, and selective control. Autonomous control is achieved by using actuators that interact with input devices in the vehicle. The actuators (e.g., linkages) manipulate the input devices (e.g., articulation controls and drive controls, such as a throttle, brake, tie rods, steering gear, throttle lever, or accelerator) to direct the operation of the vehicle. Although operating autonomously, manual operation of the vehicle is possible following the detection of events that suggest manual control is desired. Subsequent autonomous control may be permitted, permitted after a prescribed delay, or prevented. Systems and methods for processing safety signals and/or tracking terrain features are also utilized by an autonomous vehicle.

WO 2006/047297 A3

INTERNATIONAL SEARCH REPORT

tional application No
PCT/US2005/037918

A. CLASSIFICATION OF SUBJECT MATTER
 INV. B60W50/02 B60W50/08 B60W40/02 G05D1/02

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

B. FIELDS SEARCHED
 Minimum documentation searched (classification system followed by classification symbols)
 G05D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
 EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 633 800 B1 (WARD ROBERT S ET AL) 14 October 2003 (2003-10-14)	1-15, 24-39, 53-65, 74-87
Y	column 2, line 61 - column 4, line 8; claims; figures	16-23, 66-73
Y	----- US 2004/210345 A1 (NODA KUNIAKI ET AL) 21 October 2004 (2004-10-21) paragraph [0021] - paragraph [0034]; claims; figures	16-23, 66-73
X	----- US 5 987 364 A (LE GUSQUET ET AL) 16 November 1999 (1999-11-16) column 1, line 21 - column 6, line 67; figures	1-15, 24-39, 53-65, 74-87
	----- -/--	

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

* Special categories of cited documents :

A document defining the general state of the art which is not considered to be of particular relevance *E* earlier document but published on or after the international filing date *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) *O* document referring to an oral disclosure, use, exhibition or other means *P* document published prior to the international filing date but later than the priority date claimed	*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. *&* document member of the same patent family
---	---

Date of the actual completion of the international search <p style="text-align: center;">27 July 2006</p>	Date of mailing of the international search report <p style="text-align: center;">04/08/2006</p>
--	---

Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer <p style="text-align: center;">Daehnhardt, A</p>
---	--

INTERNATIONAL SEARCH REPORT

 International application No
 PCI/US2005/037918

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 448 479 A (KEMNER ET AL) 5 September 1995 (1995-09-05) column 1, line 43 - column 2, line 49; claims; figures -----	1-15, 32-39, 53-65, 81-87
X	US 6 292 725 B1 (KAGEYAMA MASATO ET AL) 18 September 2001 (2001-09-18) column 2, line 32 - column 3, line 67; claims; figures -----	1-15, 53-65
X	US 6 151 539 A (BERGHOLZ ET AL) 21 November 2000 (2000-11-21) column 3, line 51 - column 4, line 21; claims; figures -----	1,32-39, 53,81-87
X	PATENT ABSTRACTS OF JAPAN vol. 1998, no. 02, 30 January 1998 (1998-01-30) & JP 09 258826 A (YANMAR AGRICULT EQUIP CO LTD), 3 October 1997 (1997-10-03) abstract; figures -----	1,32,53, 81
X	US 2004/158355 A1 (HOLMQVIST HANS ROBERT ET AL) 12 August 2004 (2004-08-12) paragraph [0013]; claims; figures -----	1,53
A		2-39, 54-87
X	EP 0 681 230 A (GENERAL ELECTRIC COMPANY) 8 November 1995 (1995-11-08) -----	40,42, 44-49, 88,90, 92-97
Y	the whole document -----	43, 50-52, 91, 98-100
Y	DE CAMPOS A M ED - INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS: "Perception planning as a distributed decision-making process" PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON SYSTEMS, MAN AND CYBERNETICS. LE TOUQUET, OCT. 17 - 20, 1993, NEW YORK, IEEE, US, vol. VOL. 3, 17 October 1993 (1993-10-17), pages 611-616, XP010132323 ISBN: 0-7803-0911-1 the whole document -----	43, 50-52, 91, 98-100
	----- -/--	

INTERNATIONAL SEARCH REPORT

International application No PCT/US2005/037918

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 453 223 B1 (KELLY ALONZO JAMES ET AL) 17 September 2002 (2002-09-17)	40-42, 44-49, 88-90, 92-97
A	column 3, line 43 - line 67; claims; figures -----	43, 50-52, 91, 98-100

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2005/037918

Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- The additional search fees were accompanied by the applicant's protest.
- No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-39,53-87

A method and system with a behaviour based autonomous scheme, wherein at least one action set is defined and characterized at least in part by a priority

2. claims: 40-52,88-100

A method and system for tracking at least one terrain feature by an autonomous vehicle.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2005/037918

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6633800	B1	14-10-2003 WO 02061515 A2	08-08-2002
US 2004210345	A1	21-10-2004 JP 2004237392 A	26-08-2004
US 5987364	A	16-11-1999 DE 69626480 D1 DE 69626480 T2 EP 0781679 A1 ES 2194087 T3 FR 2743162 A1 JP 9193692 A	10-04-2003 18-03-2004 02-07-1997 16-11-2003 04-07-1997 29-07-1997
US 5448479	A	05-09-1995 AU 685295 B2 AU 2830695 A CA 2155252 A1 JP 3759979 B2 JP 8095635 A	15-01-1998 14-03-1996 02-03-1996 29-03-2006 12-04-1996
US 6292725	B1	18-09-2001 AU 6522798 A WO 9845765 A1 JP 3458958 B2	30-10-1998 15-10-1998 20-10-2003
US 6151539	A	21-11-2000 EP 0913751 A1 JP 11212640 A	06-05-1999 06-08-1999
JP 09258826	A	03-10-1997 NONE	
US 2004158355	A1	12-08-2004 SE 526913 C2 SE 0300001 A	15-11-2005 03-07-2004
EP 0681230	A	08-11-1995 JP 8043067 A	16-02-1996
US 6453223	B1	17-09-2002 AT 218221 T AU 5162498 A DE 69712906 D1 DE 69712906 T2 EP 0937284 A2 WO 9820399 A2 US 5999866 A	15-06-2002 29-05-1998 04-07-2002 24-04-2003 25-08-1999 14-05-1998 07-12-1999