

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
6 December 2007 (06.12.2007)

PCT

(10) International Publication Number
WO 2007/140155 A3

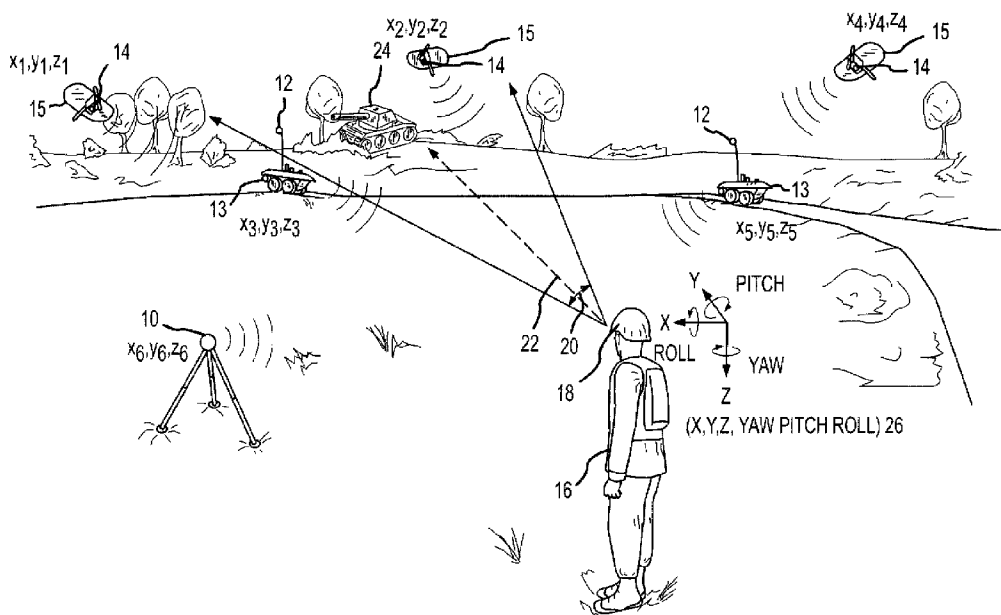
- (51) International Patent Classification:
G01C 21/00 (2006.01)
- (21) International Application Number:
PCT/US2007/069337
- (22) International Filing Date: 21 May 2007 (21.05.2007)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
11/420,079 24 May 2006 (24.05.2006) US
- (71) Applicant (for all designated States except US):
RAYTHEON COMPANY [US/US]; 870 Winter Street,
Waltham, MA 02451-1449 (US).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): LEONARD, Jon,
N. [US/US]; 1962 W. Desert Highlands Dr., Tucson,
AZ 85737-7036 (US). NEELY, Howard, E. [US/US];
1603 Dewey Street, Santa Monica, CA 94405-5854 (US).
AZUMA, Ronald, T. [US/US]; 910 19th Street, No. 107,
Santa Monica, CA 90403-3347 (US). DAILY, Michael, J.
[US/US]; 60 Inverness Road, Thousand Oaks, CA 91361
(US).

- (74) Agent: NOBLITT, Daniel, J.; Noblitt & Gilmore, Llc,
4800 North Scottsdale Road, Suite 6000, Scottsdale, AZ
85251 (US).
- (81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AT, AU, AZ, BA, BB, BG, BH, 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, GT, HN, HR, HU, ID, IL, IN,
IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR,
LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX,
MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO,
RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM,
TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, 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, MT, 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

(88) Date of publication of the international search report:
12 September 2008

(54) Title: BEACON-AUGMENTED POSE ESTIMATION



(57) Abstract: A beacon-augmented pose estimation system includes positionable beacons that can determine their own 3-D geospatial coordinates and transmit those coordinates back to the pose object. An imaging sensor images the field-of-view of the pose object to provide 2-D image coordinates for any of the beacons in the FOV. A pose object controller processes the sets of 3-D geospatial coordinates and 2-D image coordinates to refine a pose estimate of the pose object. The positionable beacons may include both static beacons that are pre-positioned and mobile beacons that are command-guided to position themselves in the pose object's likely or actual FOV.

WO 2007/140155 A3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US07/69337

A. CLASSIFICATION OF SUBJECT MATTER
 IPC: **G01C 21/00**

USPC: 701/207,220,225;342/357.01,357.06,417
 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)
 U.S. : 701/ 207, 220, 225; 342/ 357.01, 357.06, 417

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 practicable, search terms used)
 EAST

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6,922,632B2 (Foxlin) 26 July 2005 (26.07.2005), columns 12-18, lines 1-63; columns 21-26, lines 10-13; columns 29-30, lines 1-49; columns 42-43, lines 33-4	1-9, 12-26
A	US 2006/0012493 A1 (Karlsson et al.) 19 January 2006 (19.01.2006)	1-9, 12-26
A	US 6,765,569 B2 (Neumann et al.) 20 July 2004 (20.07.2004)	1-9, 12-26


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	"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
"E" earlier application or patent published on or after the international filing date	"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
"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)	"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
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search
 05 June 2008 (05.06.2008)

Date of mailing of the international search report
24 JUN 2008

Name and mailing address of the ISA/US
 Mail Stop PCT, Attn: ISA/US
 Commissioner of Patents
 P.O. Box 1450
 Alexandria, Virginia 22313-1450
 Facsimile No. (571) 273-3201

Authorized officer
 Dalena Tran 
 Telephone No. 703-308-1113