(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
25 June 2009 (25.06.2009)

PCT

(10) International Publication Number
WO 2009/077976 A3

(51) International Patent Classification:
G01C 17/28 (2006.01) *G01C 21/16* (2006.01)

(21) International Application Number:
PCT/IB2008/055319

(22) International Filing Date:
16 December 2008 (16.12.2008)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
07123510.5 18 December 2007 (18.12.2007) EP

(71) Applicant *(for all designated States except DE, US)*: **KONINKLIJKE PHILIPS ELECTRONICS N.V.** [NL/NL]; Groenewoudseweg 1, NL-5621 BA Eindhoven (NL).

(71) Applicant *(for DE only)*: **PHILIPS INTELLECTUAL PROPERTY & STANDARDS GMBH** [DE/DE]; Lübeckertordamm 5, 20099 Hamburg (DE).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **VAN ACHT, Victor, M., G.** [NL/NL]; c/o High Tech Campus, Building 44, NL-5656 AE Eindhoven (NL). **LAMBERT, Nicolaas** [NL/NL]; c/o High Tech Campus, Building 44, NL-5656 AE Eindhoven (NL). **BONGERS, Edwin, G., J., M.** [NL/NL]; c/o High Tech Campus, Building 44, NL-5656 AE Eindhoven (NL). **LANFERMANN, Gerd** [DE/DE]; c/o High Tech Campus, Building 44, NL-5656 AE Eindhoven (NL).

(74) Agents: **VAN VELZEN, Maaike, M.** et al.; High Tech Campus, Building 44, NL-5656 AE Eindhoven (NL).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, 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,

[Continued on next page]

(54) Title: ORIENTATION MEASUREMENT OF AN OBJECT

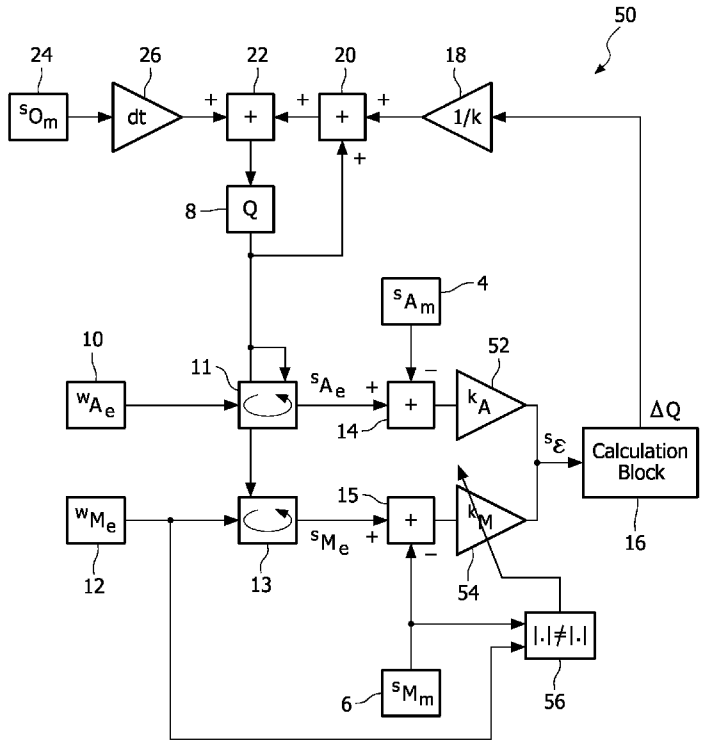


FIG. 4

(57) Abstract: There is provided an object orientation measurement system for calculating an estimate of the orientation of an object to which the system can be attached, the system comprising measurement means for taking measurements of a plurality of parametersused in calculating an estimate of the orientation of the object; and processing means for comparing a measurement of at least one of the parameters with a first predetermined value; and calculating an estimate of the orientation of the object using the measurements of the plurality of parameters, wherein the weighting of the measurement of the at least one parameter is adjusted relative to the measurement of at least one other parameter based on the result ofthe comparison.

WO 2009/077976 A3

SK, SL, SM, ST, 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, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, 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 (Art. 21(3))*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

(88) **Date of publication of the international search report**:
20 August 2009

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2008/055319

A. CLASSIFICATION OF SUBJECT MATTER
INV. G01C17/28 G01C21/16

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)
G01C G01S

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, INSPEC, WPI Data, IBM-TDB, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 014 610 A (JUDGE KEVIN [US] ET AL) 11 January 2000 (2000-01-11) column 9, line 1 - line 6 column 17, line 39 - line 41 column 17, line 49 - line 65	1-5,27
X	US 2006/217921 A1 (KOUROGI MASAKATSU [JP] ET AL) 28 September 2006 (2006-09-28) paragraph [0008] paragraph [0103]; figure 15 paragraph [0106]; figure 17 paragraphs [0125] - [0127]; figures 30,31 paragraphs [0128] - [0130]; figures 32,33	1-5, 11-18, 23,24,27
X	JP 01 287413 A (MITSUBISHI ELECTRIC CORP) 20 November 1989 (1989-11-20) abstract; figures 1,2	1,27

-/--

[X] Further documents are listed in the continuation of Box C.

[X] 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	Date of mailing of the international search report
3 April 2009	30/06/2009

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Jakob, Clemens

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2008/055319

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	SABATINI A M: "Quaternion-based extended Kalman filter for determining orientation by inertial and magnetic sensing" IEEE TRANSACTIONS ON BIOMEDICAL ENGINEERING IEEE USA, vol. 53, no. 7, July 2006 (2006-07), pages 1346-1356, XP002522559 ISSN: 0018-9294 abstract; figure 1 -----	1,27

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2008/055319

Box No. 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 No. 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 allsearchable claims.

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

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search reportcovers 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.:

see annex

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ 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: 1-27

   calculating orientation estimates by adjusting the weighting of one of the contributing parameters relative to the other parameter(s) based on the result of a comparison of samples of this parameter with a predetermined value

   ---

2. claims: 28-37

   calculating an estimate of the orientation of the object using an acceleration measurement and an azimuth angle determined from a magnetic field measurement

   ---

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IB2008/055319

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6014610 A	11-01-2000	NONE	
US 2006217921 A1	28-09-2006	JP 3837533 B2	25-10-2006
		JP 2004264028 A	24-09-2004
		WO 2004063667 A1	29-07-2004
JP 1287413 A	20-11-1989	NONE	