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- as to the identity of the inventor (Rule 4.17(i))
- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))

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[Continued on next page]

(54) Title: GESTURE TRACKING AND CLASSIFICATION

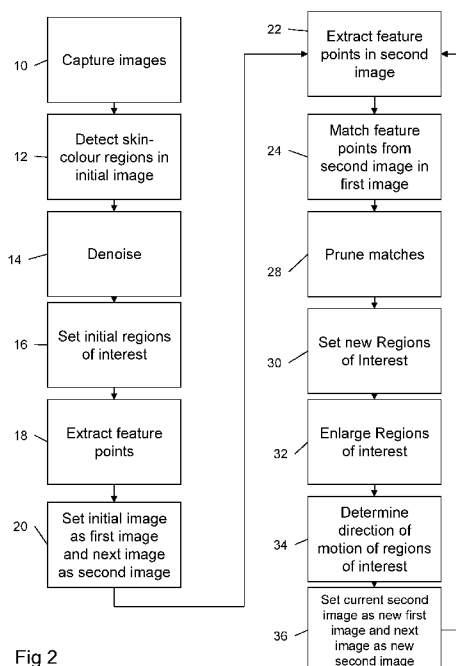


Fig 2

(57) Abstract: A method of tracking the position of a body part, such as a hand, in captured images, the method comprising capturing (10) colour images of a region to form a set of captured images; identifying contiguous skin-colour regions (12) within an initial image of the set of captured images; defining regions of interest (16) containing the skin-coloured regions; extracting (18) image features in the regions of interest, each image feature relating to a point in a region of interest; and then, for successive pairs of images comprising a first image and a second image, the first pair of images having as the first image the initial image and a later image, following pairs of images each including as the first image the second image from the preceding pair and a later image as the second image: extracting (22) image features, each image feature relating to a point in the second image; determining matches (24) between image features relating to the second image and image features relating to in each region of interest in the first image; determining the displacement within the image of the matched image features between the first and second images; disregarding (28) matched features whose displacement is not within a range of displacements; determining regions of interest (30) in the second image containing the matched features which have not been disregarded; and determining the direction of movement (34) of the regions of interest between the first image and the second image.



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- *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:**
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INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2014/050996

A. CLASSIFICATION OF SUBJECT MATTER INV. G06K9/00 G06K9/46 G06T7/20 ADD.		
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) G06K G06T		
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) EP0-Internal		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2011/110560 A1 (ADHIKARI SURANJIT [US]) 12 May 2011 (2011-05-12) paragraph [0040] - paragraph [0103] paragraph [0132] - paragraph [0139]; figures 5,6 ----- -/--	1,2,6-14
☒ 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 application or patent 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 16 July 2014		Date of mailing of the international search report 23/09/2014
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Grigorescu, Cosmin

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2014/050996

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	T. PLÖTZ ET AL: "Robust hand detection in still video images using a combination of salient regions and color cues for interaction with an intelligent environment", PATTERN RECOGNITION AND IMAGE ANALYSIS, vol. 18, no. 3, 1 September 2008 (2008-09-01), pages 417-430, XP055129056, ISSN: 1054-6618, DOI: 10.1134/S1054661808030097	1,2
Y	Section 3. "Hand detection using a combination of SIFT and color features"	3,13
Y	----- RICHARZ J ET AL: "Real-time detection and interpretation of 3D deictic gestures for interaction with an intelligent environment", 19TH INTERNATIONAL CONFERENCE ON PATTERN RECOGNITION, 2008: ICPR 2008; 8 - 11 DEC. 2008, TAMPA, FLORIDA, USA, IEEE, PISCATAWAY, NJ, 8 December 2008 (2008-12-08), pages 1-4, XP031412202, ISBN: 978-1-4244-2174-9 Section 3. "System architecture"	3
Y	----- TAEHEE LEE ET AL: "Multithreaded Hybrid Feature Tracking for Markerless Augmented Reality", IEEE TRANSACTIONS ON VISUALIZATION AND COMPUTER GRAPHICS, IEEE SERVICE CENTER, LOS ALAMITOS, CA, US, vol. 15, no. 3, 1 May 2009 (2009-05-01), pages 355-368, XP011448427, ISSN: 1077-2626, DOI: 10.1109/TVCG.2008.190 Section 3.4. "Expanding a tracking region"	13
A	----- US 2012/106792 A1 (KANG WOO-SUNG [KR] ET AL) 3 May 2012 (2012-05-03) the whole document	3
A	----- WO 2012/139241 A1 (INTEL CORP [US]; DING DAYONG [CN]; TONG XIAOFENG [CN]; LI JIANGUO [CN]) 18 October 2012 (2012-10-18) abstract	3
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INTERNATIONAL SEARCH REPORT

International application No

PCT/GB2014/050996

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JIATONG BAO ET AL: "Dynamic hand gesture recognition based on SURF tracking", ELECTRIC INFORMATION AND CONTROL ENGINEERING (ICEICE), 2011 INTERNATIONAL CONFERENCE ON, IEEE, 15 April 2011 (2011-04-15), pages 338-341, XP031874583, DOI: 10.1109/ICEICE.2011.5777598 ISBN: 978-1-4244-8036-4 Section II. "Modeling of dynamic hand gesture" -----	15-19

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB2014/050996

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 all searchable 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 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.:

1-3, 6-19

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: 1-3, 6-19

Feature-based tracking of a body part

2. claims: 4, 5

Denoising of the skin colour regions

3. claim: 20

Discarding intermediate images during tracking

4. claims: 21-28

Gesture classification

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2014/050996

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2011110560 A1	12-05-2011	CA 2774974 A1	12-05-2011
		CN 102576259 A	11-07-2012
		EP 2478427 A2	25-07-2012
		JP 5455167 B2	26-03-2014
		JP 2013508827 A	07-03-2013
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		WO 2012139241 A1	18-10-2012
