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Declarations under Rule 4.17:

— as to applicant's entitlement to apply for and be granted a patent (Rule 4.1 7(H))

[Continued on nextpage]

(54) Title: TOUCHLESS SENSING AND GESTURE RECOGNITION USING CONTINUOUS WAVE ULTRASOUND SIGNALS

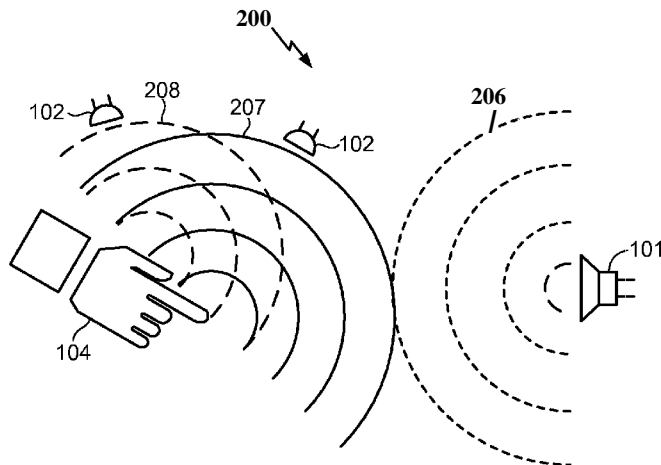


FIG. 2

(57) Abstract: The embodiments provide systems and methods for touchless sensing and gesture recognition using continuous wave sound signals. Continuous wave sound, such as ultrasound, emitted by a transmitter may reflect from an object, and be received by one or more sound receivers. Sound signals may be temporally encoded. Received sound signals may be processed to determine a channel impulse response or calculate time of flight. Determined channel impulse responses may be processed to extract recognizable features or angles. Extracted features may be compared to a database of features to identify a user input gesture associated with the matched feature. Angles of channel impulse response curves may be associated with an input gesture. Time of flight values from each receiver may be used to determine coordinates of the reflecting object. Embodiments may be implemented as part of a graphical user interface. Embodiments may be used to determine a location of an emitter.



— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(Hi))* — *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))*

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A. CLASSIFICATION OF SUBJECT MATTER
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 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)
 G06F 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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	wo 2009/122 193 AI (ELLI PTIC LAB AS [NO] ; DAHL TOBIAS [NO] ; BIRKEDAL GEIR [NO] ; SYVERSRUD) 8 October 2009 (2009-10-08) page 1, lines 1-25 page 3, lines 17-26 page 7, line 2 - page 8, line 21 page 9, line 27 - page 10, line 6 page 11, line 26 - page 12, line 14 page 13, line 19 - page 14, line 13 page 15, line 15 - page 16, line 25 page 17, line 17 - page 18, line 19 page 19, lines 6-9 page 19, line 25 - page 20, line 8 page 25, lines 4-10 page 25, line 27 - page 26, line 6 page 29, lines 13-23 ----- -/- .	1-69

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
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"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 19 March 2012	Date of mailing of the international search report 23/03/2012
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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 Fournier, Nicolas
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	wo 2009/115799 AI (ELLI PTIC LAB AS [NO] ; DAHL TOBIAS [NO] ; SAMUELS ADRIAN JAMES) 24 September 2009 (2009-09-24) the whol e document	1-69

A	wo 2004/102301 A2 (QINETIQ LTD [GB] ; STANLEY MAURICE [GB] ; SCATTERGOOD DAVID CHARLES [GB]) 25 November 2004 (2004-11-25) the whol e document	1-69

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/US2011/042452
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2009122193 A1	08-10-2009	EP 2271951 A1	12-01-2011
		JP 2011516848 A	26-05-2011
		US 2011103448 A1	05-05-2011
		WO 2009122193 A1	08-10-2009

WO 2009115799 A1	24-09-2009	AU 2009227717 A1	24-09-2009
		CA 2718680 A1	24-09-2009
		CN 102027440 A	20-04-2011
		EP 2281231 A1	09-02-2011
		JP 2011517584 A	16-06-2011
		US 2011096954 A1	28-04-2011
		WO 2009115799 A1	24-09-2009

WO 2004102301 A2	25-11-2004	CN 1973258 A	30-05-2007
		EP 1623296 A2	08-02-2006
		JP 4771951 B2	14-09-2011
		JP 2007503653 A	22-02-2007
		US 2006238490 A1	26-10-2006
		WO 2004102301 A2	25-11-2004
