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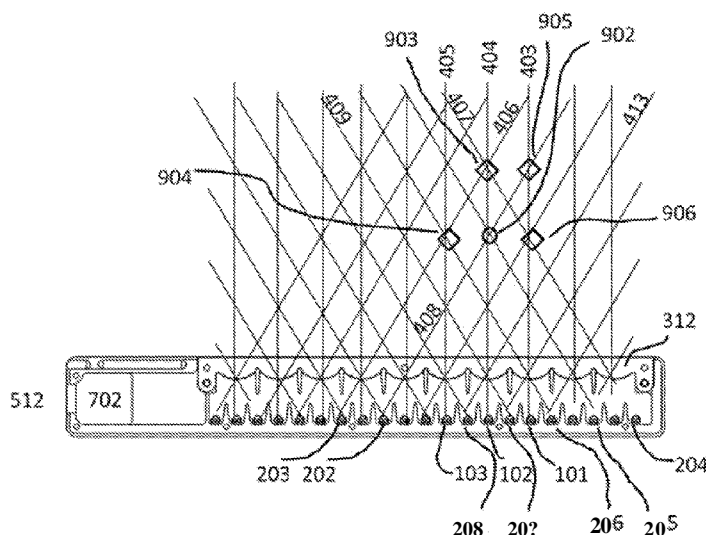
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[Continued on nextpage]

(54) Title: OPTICAL PROXIMITY SENSORS

**FIG. 2**

(57) Abstract: A proximity sensor including a housing, a plurality of light pulse emitters for projecting light out of the housing along a detection plane, a plurality of primary light detectors for detecting reflections of the light projected by the emitters, by a reflective object in the detection plane, a plurality of primary lenses oriented relative to the emitters and primary detectors in such a manner that for each emitter-detector pair, light emitted by the emitter of that pair passes through one of the primary lenses and is reflected by the object back through one of the primary lenses to the detector of that pair when the object is located at a position, from among a primary set of positions in the detection plane, that position being associated with that emitter-detector pair, and a processor for co-activating emitter-detector pairs, and configured to calculate a location of the object in the detection plane.



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- *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))*

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2014/0401 12

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - G06F 3/041 (2014.01)

CPC - G06F 3/041

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)

IPC(8) - A63F 13/00; G06F 3/042, 3/041, 15/173 (2014.01)

USPC - 345/175; 463/40; 709/224

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
CPC - A63F 13/00; G06F 3/042, 3/041, 15/173 (2014.09) (keyword delimited)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

Google, Orbit, Google Patents

Search terms used: Lens arrangement, light-based touch screen, blocking material, photo detectors, light emitter, layers, sensing, finger touch, pressure

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y -- A	US 2010/0238139 A1 (GOERTZ et al) 23 September 2010 (23.09.2010) entire document	1, 3, 5-15, 18, 19, 21-23, 28, 29 ----- 2, 4
Y	US 201 1/0169781 A1 (GOERTZ et al) 14 July 201 1 (14.07.201 1) entire document	1, 3, 5-13
Y	US 2008/001651 1 A1 (HYDER et al) 17 January 2008 (17.01.2008) entire document	3
Y	US 2012/0188205 A1 (JANSSON et al) 26 July 2012 (26.07.2012) entire document	5
Y	US 7162124 B1 (GUNN III et al) 09 January 2007 (09.01.2007) entire document	10
Y	WO 2012/017183 A1 (ALLANO et al) 09 February 2012 (09.02.2012) entire document	11
Y	US 2013/0127790 A1 (WASSVIK) 23 May 2013 (23.05.2013) entire document	14,15
Y	US 201 1/0122560 A1 (ANDRE et al) 26 May 201 1 (26.05.201 1) entire document	14,15
Y	US 2012/0131 186 A1 (KLOS et al) 24 May 2012 (24.05.2012) entire document	16-32
Y	US 2009/0280905 A1 (WEISMAN et al) 12 November 2009 (12.11.2009) entire document	16-32
Y	US 2009/0195402 A1 (IZADI et al) 06 August 2009 (06.08.2009) entire document	22,23,31 ,32
A	US 2012/0262408 A1 (PASQUERO et al) 18 October 2012 (18.10.2012) entire document	1-32

☐ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:	"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
"A" document defining the general state of the art which is not considered to be of particular relevance	"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
"E" earlier application or patent but published on or after the international filing date	"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
"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)	"G" document member of the same patent family
"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	

Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2014/0401 12

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 Extra 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 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.:

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.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2014/0401 12

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I, claims 1-13, drawn to a proximity sensor for determining two-dimensional coordinates of a proximal object.

Group II, claims 14-15, drawn to a proximity sensor for determining directional movement of a finger along a slider control.

Group III, claims 16-32, drawn to a handheld electronic game device.

The inventions listed as Groups I, II or III do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: the special technical feature of the Group I invention: "a plurality of primary lenses mounted and oriented in said housing relative to said emitters and said primary detectors in such a manner that for each emitter-detector pair, light emitted by the emitter of that pair passes through one of the primary lenses and is reflected by the object back through one of the primary lenses to the detector of that pair when the object is located at a two-dimensional position, from among a primary set of positions in the detection plane, that position being associated with that emitter-detector pair" as claimed therein is not present in the invention of Groups II or III. The special technical feature of the Group II invention: "a multi-layer, light transmissive cover mounted in said housing and having an exposed upper surface for a slider control, wherein a border between the layers of the cover comprises a pattern of light transmissive portions separated by opaque or reflective portions, wherein the sizes of the light-transmissive portions, or of the opaque or reflective portions, increase across the pattern" as claimed therein is not present in the invention of Groups I or III. The special technical feature of the Group III invention: "a housing; a communicator mounted in said housing for communicating with an internet game server; a display mounted in said housing for rendering a portion of a game user interface (UI) received by said communicator from the game server" as claimed therein is not present in the invention of Groups I or II.

Groups I, II and III lack unity of invention because even though the inventions of these groups require the technical feature of a handheld electronic game device comprising a sensor in a housing wherein the sensor comprising light pulse emitters, light detectors and a processor, this technical feature is not a special technical feature as it does not make a contribution over the prior art.

Specifically, US 2012/0262408 A1 (PASQUERO et al) teaches a handheld electronic game device (the portable electronic device may also be a handheld electronic device, para. 0013) comprising a sensor in a housing wherein the sensor comprising light pulse emitters, light detectors and a processor (fig.1 shows light pulse emitters (emitters 152), light detectors (optical detectors 154) and a processor 102 in a housing 202 (fig.2), para. 0021, 0023, 0027).

Since none of the special technical features of the Group I, II or III inventions are found in more than one of the inventions, unity of invention is lacking.