A capacitive sensor for detecting a stimulus. The capacitive sensor includes first and second electrodes defining a capacitive coupling, and a processing unit electrically coupled to the first and second electrodes to determine the presence of a stimulus based on the rate of change of the capacitive coupling. A substrate is positioned adjacent the first and second electrodes, wherein the stimulus corresponds to the placement of an object against the substrate. The processing unit is operative to determine a time rate of change based on successive measurements of the capacitive coupling and in response to the capacitive coupling being greater than a predetermined reference value.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
IPC (8) - G06F 3/041, 3/044 (2013.01)
USPC - 327/517, 324/679
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) Classification(s): G06F 3/041, 3/044. G06R 27/26, H03K 17/96 (2013.01);
USPC Classification(s): 327/517, 324/679, 345/174, 345/173; "T/B/190"

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)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>US 7,009,663 B2 (ABILEAH, A. et al.) March 7, 2006, figures 1, 16, 13, 17-23, 33 and 36, column 3 lines 23-33; column 6, lines 34-65; column 13, lines 7-54; column 14, line 61- column 17, line 17; column 25, lines 29-49.</td>
<td>64, 67-70, 65-66, 78, 80</td>
</tr>
<tr>
<td>Y</td>
<td>US 201 0/254672 A (CIESLA, C. et al.) October 20, 201 1, figures 6, 7A and 7B, paragraphs [0191H0026].</td>
<td>129-131</td>
</tr>
</tbody>
</table>

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

Date of the actual completion of the international search 27 September 2013 (27.09.2013)

Date of mailing of the international search report 18 OCT 2013

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

Authorized officer: Shane Thomas
**INTERNATIONAL SEARCH REPORT**

**INTERNATIONAL application No.**
PCT/US 13/38323  

**C (Continuation).** DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category*</th>
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<tbody>
<tr>
<td>Y</td>
<td>US 2010/0295813 A1 (KENT, J.) November 25, 2010, figure 1, abstract, paragraphs [0003H0008], [0019]-[0021], [0031]-[0033], [0053]-[0054],</td>
<td>19</td>
</tr>
<tr>
<td>Y</td>
<td>US 2011/0084937 A1 (CHANG, C. et al.) April 14, 2011, claim 1, figure 2A, paragraphs [0019M0022], [0048], [0055M0082], [0158], [0183]-[0184],</td>
<td>22-25, 39-40, 46-47, 105-106</td>
</tr>
<tr>
<td>Y</td>
<td>US 2012/0062516 A1 (CHEN, Q. et al.) March 15, 2012, figures 5 and 8-9, paragraphs [0073]-[0079], [0096]-[0107],</td>
<td>118-124</td>
</tr>
</tbody>
</table>
## 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).

## 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.
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 fee must be paid.

Group I: Claims 1-57 and 83-117 are directed toward a capacitive sensor comprising a capacitive sensing circuit, an output, a substrate, receipt of an object, a processing unit, a rate of change, and electrodes.

Group II: Claims 58-82 are directed toward a capacitive sensor comprising a plurality of electrode rows extending a first direction, a plurality of electrode columns extending in a second direction transverse to the first direction; and a processing unit, a rate of change, and a stimulus in two dimensions.

Group III: Claims 118-124 are directed toward a capacitive sensor comprising an upper and lower substrate, a touch input, a first and second spaced apart electrodes, a processing unit, a haptics driver, and an electrostatic force.

Group IV: Claims 125-132 are directed toward an apparatus comprising an optical sensor, an output, a processing unit, a rate of change, first and second light emitting diodes.

The inventions listed as Groups I-IV 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.

The common technical features of Groups I and II are at least a capacitive sensor comprising a processing unit, and a rate of change. The common technical features of Groups I and III are a capacitive sensor comprising a substrate, a processing unit, and electrodes. The common technical features of Groups I and IV are a sensor comprising an output, a processing unit, and a rate of change.

These common features are disclosed by US 2012/0068760 A1 to Caldwell et al. (hereinafter Caldwell). Caldwell discloses a capacitive sensor (capacitive sensor 102, figure 4, paragraph [0033]) comprising a processing unit (processing unit, paragraph [0009]), a rate of change (rate of change of the electrode capacitance, paragraph [0009]), electrodes (electrodes 120 and 122, figure 4, paragraph [0033]), and a substrate (substrate, paragraph [0009]).

Since the common technical feature is previously disclosed by the Caldwell reference, this common feature is not special and so Groups I-IV lack unity.