INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2015/047282

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.:

1-198, 223-353, 375-385, 388-392, 394-397

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.

AliveCor Exhibit 1002
AliveCor, Inc. v. Apple Inc.
IPR2023-01434, U.S. Patent No. 10,270,898
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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2015/047282

A. CLASSIFICATION OF SUBJECT MATTER
INV. G06F19/00
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 A63B A61B

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)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2014/239065 A1 (ZHOU TIGER T G [US] ET AL) 28 August 2014 (2014-08-28) paragraph [0005] - paragraph [0024] paragraph [0042] - paragraph [0050] paragraph [0086] - paragraph [0090] figures 1-7 -----	1-46, 223-243, 375-377, 388
X	US 2014/139637 A1 (MISTRY PRANAV [US] ET AL) 22 May 2014 (2014-05-22) paragraph [0005] - paragraph [0097] paragraph [0217] figures 1-157 -----	1-46, 223-243, 375-377, 388

-/--

[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 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	Date of mailing of the international search report
29 April 2016	09/05/2016

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	Schechner-Resom, M

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Form PCT/ISA/210 (second sheet) (April 2005)

AliveCor Exhibit 1002
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IPR2023-01434, U.S. Patent No. 10,270,898
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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	US 2014/244009 A1 (MESTAS ALEX [US]) 28 August 2014 (2014-08-28) paragraph [0005] - paragraph [0210] paragraph [0325] - paragraph [0360] figures 1-181	1-198, 223-353, 375-385, 388-392, 394-397
A	US 2013/203475 A1 (KIL DAVID H [US] ET AL) 8 August 2013 (2013-08-08) paragraph [0004] - paragraph [0024] figures 1-12	1-46, 223-243, 375-377, 388
X	US 2006/052727 A1 (PALESTRANT LAURENCE [US]) 9 March 2006 (2006-03-09)	47-71, 244-265, 378,379, 389,394
A	paragraph [0030] - paragraph [0033] paragraph [0060] - paragraph [0064] figures 1-6	72-115, 266-306, 380,381, 390,395
X	US 2013/184613 A1 (HOMSI KRISTOPHER L [US] ET AL) 18 July 2013 (2013-07-18)	72-115, 266-306, 380,381, 390,395
A	paragraph [0019] - paragraph [0073] figures 1-3	47-71, 244-265, 378,379, 389,394
X	US 2013/106684 A1 (WEAST AARON B [US] ET AL) 2 May 2013 (2013-05-02) paragraph [0370] - paragraph [0375]; figures 119-135	116-135, 307-323, 382,383, 391,396
X	US 2011/261079 A1 (INGRASSIA JR MICHAEL [US] ET AL) 27 October 2011 (2011-10-27) paragraph [0020] - paragraph [0063]; figures 1-11	136-198, 324-353, 384,385, 392,397
A	EP 2 025 368 A2 (ADIDAS INT MARKETING BV [NL]) 18 February 2009 (2009-02-18) the whole document	136-198, 324-353, 384,385, 392,397

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2015/047282

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2014239065 A1	28-08-2014	NONE	
US 2014139637 A1	22-05-2014	AU 2013260683 A1	05-06-2014
		CN 104919390 A	16-09-2015
		EP 2733579 A2	21-05-2014
		US 2014139637 A1	22-05-2014
		US 2015181087 A1	25-06-2015
		WO 2014081181 A1	30-05-2014
US 2014244009 A1	28-08-2014	BR 102014004317 A2	07-07-2015
		CN 104122994 A	29-10-2014
		EP 2770454 A1	27-08-2014
		JP 2014168685 A	18-09-2014
		KR 20140105407 A	01-09-2014
		US 2014244009 A1	28-08-2014
		WO 2014130805 A1	28-08-2014
US 2013203475 A1	08-08-2013	US 2013203475 A1	08-08-2013
		WO 2013113036 A1	01-08-2013
US 2006052727 A1	09-03-2006	NONE	
US 2013184613 A1	18-07-2013	CA 2862214 A1	25-07-2013
		CA 2868009 A1	25-07-2013
		CN 104169922 A	26-11-2014
		CN 104169923 A	26-11-2014
		EP 2805271 A1	26-11-2014
		EP 2805272 A1	26-11-2014
		JP 2015509755 A	02-04-2015
		JP 2015511133 A	16-04-2015
		KR 20140117545 A	07-10-2014
		KR 20140117548 A	07-10-2014
		US 2013184613 A1	18-07-2013
		US 2013185016 A1	18-07-2013
		WO 2013109776 A1	25-07-2013
		WO 2013109777 A1	25-07-2013
US 2013106684 A1	02-05-2013	CA 2801134 A1	18-07-2013
		CN 103212197 A	24-07-2013
		EP 2618282 A2	24-07-2013
		EP 2805270 A2	26-11-2014
		EP 2838045 A1	18-02-2015
		JP 2013146557 A	01-08-2013
		JP 2015515287 A	28-05-2015
		KR 20130084993 A	26-07-2013
		US 2013106684 A1	02-05-2013
		US 2014180453 A1	26-06-2014
		US 2014180454 A1	26-06-2014
		US 2014180455 A1	26-06-2014
		US 2014180456 A1	26-06-2014
		WO 2013109577 A2	25-07-2013
US 2011261079 A1	27-10-2011	NONE	
EP 2025368 A2	18-02-2009	CN 101367012 A	18-02-2009
		CN 105396277 A	16-03-2016
		EP 2025368 A2	18-02-2009
		EP 2724755 A1	30-04-2014

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2015/047282

Patent doument cited in search report	Publication date	Patent family member(s)	Publication date
		EP 2724758 A1	30-04-2014
		JP 5095554 B2	12-12-2012
		JP 5465285 B2	09-04-2014
		JP 2009078134 A	16-04-2009
		JP 2012228568 A	22-11-2012
		US 2009047645 A1	19-02-2009
		US 2014342329 A1	20-11-2014

Form PCT/ISA/210 (patent family annex) (April 2005)

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FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-46, 223-243, 375-377, 388

   Apparatus and method to track two types of user physical activities of a user based on sensor data, and display performance vs. goals.

   ---

2. claims: 47-71, 244-265, 378, 379, 389, 394

   Apparatus and method to track user physical activity further considering inactivity periods by means of a timer.

   ---

3. claims: 72-115, 266-306, 380, 381, 390, 395

   Apparatus and method to track two types of user physical activities further considering inactivity periods.

   ---

4. claims: 116-135, 307-323, 382, 383, 391, 396

   Apparatus and method to track three types of user physical activity and display of the three activities.

   ---

5. claims: 136-198, 324-353, 384, 385, 392, 397

   Apparatus and method to assist a user in setting fitness goals.

   ---

6. claims: 199-222, 354-374, 386, 387, 393, 398

   Apparatus and method to review historical data of user physical activities.

Information on Search Strategy - Pilot phase (see OJ 2015, A86)
The type of information contained in this sheet may change during the pilot for improving the usefulness of this new service.

Application Number
PCT/US2015/047282

TITLE: PHYSICAL ACTIVITY AND WORKOUT MONITOR

APPLICANT: APPLE INC.

IPC CLASSIFICATION: G06F19/00

EXAMINER: Schechner-Resom, M

CONSULTED DATABASES: DOSYS, EPODOC, WPI, TXTE, INET

CLASSIFICATION SYMBOLS DEFINING EXTENT OF THE SEARCH:

IPC:

CPC: G06F19/3481

FI/F-TERMS:

KEYWORDS OR OTHER ELEMENTS FEATURING THE INVENTION:

EPO FORM P04A42

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

see form PCT/ISA/220

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY
(PCT Rule 43*bis*.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US2015/047282	27.08.2015	02.09.2014

International Patent Classification (IPC) or both national classification and IPC
INV. G06F19/00

Applicant
APPLE INC.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☒ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☒ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☒ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notifed the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA:	Date of completion of this opinion	Authorized Officer
European Patent Office P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Fax: +31 70 340 - 3016	see form PCT/ISA/210	Schechner-Resom, M Telephone No. +31 70 340-0

Form PCT/ISA/237 (Cover Sheet) (January 2015)

Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of:

   ☒ the international application in the language in which it was filed.

   ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1 (b)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))

3. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:

   a. ☐ forming part of the international application as filed:

      ☐ in the form of an Annex C/ST.25 text file.

      ☐ on paper or in the form of an image file.

   b. ☐ furnished together with the international application under PCT Rule 13*ter*.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.

   c. ☐ furnished subsequent to the international filing date for the purposes of international search only:

      ☐ in the form of an Annex C/ST.25 text file (Rule 13*ter*.1(a)).

      ☐ on paper or in the form of an image file (Rule 13*ter*.1(b) and Administrative Instructions, Section 713).

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

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Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non obvious), or to be industrially applicable have not been examined in respect of

☐ the entire international application

☒ claims Nos. 199-222, 354-374, 386, 387, 393, 398

because:

☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international search *(specify)*:

☐ the description, claims or drawings *(indicate particular elements below)* or said claims Nos. are so unclear that no meaningful opinion could be formed *(specify)*:

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed *(specify)*:

☒ no international search report has been established for the whole application or for said claims Nos. 199-222, 354-374, 386, 387, 393, 398

☐ a meaningful opinion could not be formed without the sequence listing; the applicant did not, within the prescribed time limit:

- ☐ furnish a sequence listing in the form of an Annex C/ST.25 text file, and such listing was not available to the International Searching Authority in the form and manner acceptable to it; or the sequence listing furnished did not comply with the standard provided for in Annex C of the Administrative Instructions.
- ☐ furnish a sequence listing on paper or in the form of an image file complying with the standard provided for in Annex C of the Administrative Instructions, and such listing was not available to the International Searching Authority in the form and manner acceptable to it; or the sequence listing furnished did not comply with the standard provided for in Annex C of the Administrative Instructions.
- ☐ pay the required late furnishing fee for the furnishing of a sequence listing in response to an invitation under Rule 13*ter*.1(a) or (b).

☒ See Supplemental Box for further details

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Box No. IV Lack of unity of invention

1. ☒ In response to the invitation (Form PCT/ISA/206) to pay additional fees, the applicant has, within the applicable time limit:

   ☒ paid additional fees

   ☐ paid additional fees under protest and, where applicable, the protest fee

   ☐ paid additional fees under protest but the applicable protest fee was not paid

   ☐ not paid additional fees

2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose not to invite the applicant to pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with Rule 13.1, 13.2 and 13.3 is

   ☐ complied with

   ☒ not complied with for the following reasons:

   see separate sheet

4. Consequently, this report has been established in respect of the following parts of the international application:

   ☐ all parts.

   ☒ the parts relating to claims Nos. 1-198, 223-353, 375-385, 388-392, 394-397

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Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	7-9, 11, 12, 14-20, 28-30, 32, 33, 35-41, 49-52, 55-62, 66, 67, 72-115, 119, 120, 122-128, 138, 139, 141-143, 155-157, 164-166, 169, 170, 172-174, 186-188, 194-196, 227-229, 231, 232, 234-240, 246-249, 252-259, 263, 264, 266-306, 310, 311, 313-319, 326, 327, 329-331, 343-345, 351-353, 380, 381, 390, 395
	No:	Claims	1-6, 10, 13, 21-27, 31, 34, 42-48, 53, 54, 63-65, 68-71, 116-118, 121, 129-137, 140, 144-154, 158-163, 167, 168, 171, 175-185, 189-193, 197, 198, 223-226, 230, 233, 241-245, 250, 251, 260-262, 265, 307-309, 312, 320-325, 328, 332-342, 346-350, 375-379, 382-385, 388, 389, 391, 392, 394, 396, 397
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-198, 223-353, 375-385, 388-392, 394-397
Industrial applicability (IA)	Yes:	Claims	1-198, 223-353, 375-385, 388-392, 394-397
	No:	Claims	

2. Citations and explanations

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

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Re Item III

Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

As the fees have only been paid for the 5 first inventions, claims 199-222, 354-374, 386, 387, 393, 398 have not been searched and will not be discussed in the following.

Re Item IV

Lack of unity of invention

1.1 This Authority considers that the application does not meet the requirements of unity of invention and that there are 6 inventions covered by the claims. These inventions correspond to the six sets of claims also noted by the Applicant in his response to the invitation to provide informal clarification. The different inventions are the following:

Invention 1: claims: 1-46, 223-243, 375-377, 388

Apparatus and method to track two types of user physical activities of a user based on sensor data, and display performance vs. goals.

Invention 2: claims: 47-71, 244-265, 378, 379, 389, 394

Apparatus and method to track user physical activity further considering inactivity periods by means of a timer.

Invention 3: claims: 72-115, 266-306, 380, 381, 390, 395

Apparatus and method to track two types of user physical activities further considering inactivity periods, based on sensor data.

Invention 4: claims: 116-135, 307-323, 382, 383, 391, 396

Apparatus and method to track three types of user physical activity and display of the three activities, based on sensor data.

Invention 5: claims: 136-198, 324-353, 384, 385, 392, 397

Apparatus and method to assist a user in setting fitness goals.

Invention 6: claims: 199-222, 354-374, 386, 387, 393, 398

Apparatus and method to review historical data of user physical activities.

1.2 The reasons for which the inventions are not so linked as to form a single general inventive concept, as required by Rule 13.1 PCT, are as follows:

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The only possible common feature of claims 1-398 is a method and an apparatus to display user physical activity, by means of a user interface. Inventions 1-4 further comprise sensors. These common features are well-known in the prior art and therefore can not form the required link between the above-mentioned inventions. An example of prior art comprising such features is US 2014/239065 A1 (ZHOU TIGER T G [US] ET AL) 28 August 2014 (2014-08-28).

Since inventions 1 to 6 have no common special technical features, nor do they solve a common problem, these inventions do not form a single inventive concept and do not have unity of invention as required by Rule 13.2 PCT.

As four additional inventions have been paid for the first 5 inventions, the first 5 inventions have been searched and will be discussed in the following.

Invention 1: claims: 1-46, 223-243, 375-377, 388

Apparatus and method to track two types of user physical activities of a user based on sensor data, and display performance vs. goals.

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1.3 Reference is made to the following documents:

D1	US 2014/239065 A1 (ZHOU TIGER T G [US] ET AL) 28 August 2014 (2014-08-28)
D2	US 2014/139637 A1 (MISTRY PRANAV [US] ET AL) 22 May 2014 (2014-05-22)
D3	US 2014/244009 A1 (MESTAS ALEX [US]) 28 August 2014 (2014-08-28)
D4	US 2013/203475 A1 (KIL DAVID H [US] ET AL) 8 August 2013 (2013-08-08)

Claims 1-23 (apparatus)

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2 The present application does not meet the requirements of Article 33(1) PCT because the subject-matter of claim 1 is not novel under Article 33(2) PCT.

2.1 Following as much as possible the wording of the claim, document D1 discloses (the references in parenthesis applying to this document):

An electronic device comprising:
a sensor configured to detect movement associated with the electronic device and generate activity data based on the detected movement **(paragraph 0020 "biometric data [...] one or more sensors [...] GPS and/or one or more accelerometers");**

a display **(paragraph 0019 "display");**

a non-transitory computer readable storage medium comprising instructions for:
determining that a physical activity has been performed by a user wearing the electronic device, based on the activity data received from the sensor **(paragraph 0049 "motion sensor"; see also paragraph 0089 "continuously monitor biometric parameters");**

determining whether the physical activity corresponds to a first type based on a first set of criteria and
determining whether the physical activity corresponds to a second type based on a second set of criteria **(paragraph 0050 "identify user activities, identify a specific motion fingerprint of an exercise"; see also paragraph 0049 "boxing, fencing basketball [etc]");**

in response to determining that the physical activity corresponds to the first type, updating a first value stored in a memory based on the activity data;
in response to determining that the physical activity corresponds to the second type, updating a second value stored in the memory based on the activity data **(paragraph 0043 "calculating [...] steps and/or distance walked";**

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paragraph 0050 "count repetitions"; see also paragraph 0044 processed by the processor to receive historical or averaged biometric data");

displaying a first indicator representative of the first value, the first value representing an aggregate amount of the first type of physical activity detected from the sensor over a period of time, and displaying a second indicator representative of the second value, the second value representing an aggregate amount of the second type of physical activity detected from the sensor over the period of time **(paragraph 0044 "the biometric parameters [...] may be shown on the display");** and

one or more processors operatively coupled to the sensor, the non-transitory computer readable storage medium, and the display, wherein the one or more processors are capable of executing the instructions of the non-transitory computer-readable storage medium **(paragraphs 0023-0024 "a processor, memory unit [...] local processing performed by the processor using various software applications installed on the WPD device").**

2.2 The additional features defined in the following claims are also anticipated in D1 and therefore they are not novel in the sense of Article 33(2) PCT. The relevant passages in D1 are the following:

- Claims 2-4 (sensors): see cited passages for claim 1.

- Claim 5 (steps): Paragraph 0043 "steps".

- Claims 6, 13 (calories): Paragraph 0043 "calories burned".

- Claim 10 (3rd type of activity): see cited passages for claim 1, several activities can be identified.

- Claim 21 (remote connections): Paragraph 0021 discloses network connectivity; see also paragraph 0087

- Claim 22 (touch display): paragraph 0024 "touchscreen display"

- Claim 23 (a watch): Figure 1.

2.3 The additional features defined in the following claims are not considered to involve an inventive step (Article 33(3) PCT) for the following reasons:

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- Claim 7 (speed): Document D1, paragraph 0043 "distance walked". measuring speed is well-known in the art, see document D3.

- Claims 8, 9,11, 12 (subsets of other types): The defined relationships between 1st and 2nd activity types are considered straightforward alternatives and therefore not inventive.

- Claims 14, 15 (aggregates, image/text): Well-known in the art, see document D3, figures 126A-C and 127 A-C as an example.

- Claim 16 (display value vs. goal): Document D1 defines goals (paragraph 0087). Displaying current performance with goals is not deemed inventive in view of D3, see for example figure 126B.

Claims 17, 18 (rings, bars): Known in the art. See cited passages in the search report for D3 as an example, in particular figures 94A-D, 126A-C, 127A-C.

- Claim 19 (goal increase): Known in the art, see D3, paragraph 0325 as an example.

- Claim 20 (1day): Known in the art. See D3, figure 119.

2.4 The attention is further drawn to document D2, in view of which the claimed subject-matter is not considered inventive under Article 33(3) PCT.

3 **Claims 24-44 (method)**

3.1 The features of method claim 24 are a combination of the corresponding apparatus features of claims 1 and 2. Therefore, the same objections apply, mutatis mutandis, to the subject-matter of independent claim 24, which is therefore considered not novel under Article 33(2) PCT.

3.2 The objections raised for claims 4-23 apply, mutatis mutandis, to the subject-matter of claims 245-44, which are therefore considered not novel (Art. 33(2) PCT or not inventive (Art. 33(3) PCT) correspondingly.

4 **Claims 45, 46, 223-243, 375-377, 388 (device)**

4.1 The objections raised for independent claim 1 apply, mutatis mutandis, to the subject-matter of independent claims 45, 46 , 223, 375-377, 388, which are therefore considered not novel under Article 33(2) PCT.

4.2 The objections raised for claims 2-23 apply, mutatis mutandis , to the subject-matter of dependent claims 224-243 which are therefore considered not novel (Article 33(2) PCT) or not inventive (Article 33(3) PCT) correspondingly.

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5 **Article 6 PCT**

5.1 Although claims 1, 46, 223, 375, 377 and 388 have been drafted as separate independent apparatus claims, they appear to relate effectively to the same subject-matter and to differ from each other only with regard to the definition of the subject-matter for which protection is sought and/or in respect of the terminology used for the features of that subject-matter. The aforementioned claims therefore lack conciseness and as such do not meet the requirements of Art. 6 PCT.

Invention 2: claims: 47-71, 244-265, 378, 379, 389, 394

Apparatus and method to track user physical activity further considering inactivity periods by means of a timer.

6 Reference is made to the following document:

D5 US 2006/052727 A1 (PALESTRANT LAURENCE [US]) 9 March 2006 (2006-03-09)

D3 US 2014/244009 A1 (MESTAS ALEX [US]) 28 August 2014 (2014-08-28)

7 The present application does not meet the criteria of Article 33(2) PCT, because the subject-matter of claims 47, 69, 70, 71, 244, 378, 379, 389, 394 is not new.

7.1 D5 discloses:

A computer-implemented method comprising:

- receiving, from a sensor **(see fig. 3(44))**, activity data that is representative of physical activity performed by a user detected by the sensor **(see par 0031)**;

- controlling an inactivity timer that measures a length of time that the user is inactive based on the activity data **(see par 0032)**,

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- wherein controlling the inactivity timer comprises resetting a value of the inactivity timer in response to determining, based on the activity data, that the user has performed a threshold amount of activity **(see par 0063, fig. 6 (102)(104)(106) "RESET STATIONARY INTERVAL TIMER");** and

- displaying an inactivity tracking interface, wherein the inactivity tracking interface comprises a visual representation of the value of the inactivity timer **(see fig. 4 "50 MIN TOTAL MOVEMENT PER 60 MIN MONITORING PERIOD" gives directly the inactivity time, i.e. 10 MIN, therefore this is merely one way of displaying the inactivity count).**

7.2 Therefore independent claim 47 is not new (Art. 33(2) PCT.

7.3 The same reasoning applies, mutatis mutandis, to the subject-matter of the corresponding independent claims 69, 70, 71, 244, 378, 379, 389, 394 which therefore are also considered not new.

8 Dependent claims 48, 53, 54, 63-65, 68, 245, 250, 251, 260-262, 265 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty (Art 33(2) PCT).

- Claim 48, 245: **see fig. 6, "after pausing the inactivity timer updating an amount of detected activity to include the physical activity performed by the user"**

- Claims 53, 54, 250, 251 (display of detected activity): **see fig. 4(70)(78) "TOTAL MOVEMENT TIME"**

- Claims 63, 260 (start and pause the inactivity timer): **see fig. 6**

- Claims 64, 65, 261, 262: **see par 0063**

- Claims 68, 265: **see par 0030**

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9 Dependent claims 49-52, 55-62, 66, 67, 246-249, 252-259, 263, 264 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of inventive step (Art. 33(3) PCT).

- Claims 49, 246 (user has reached threshold amount of activity): known in the art, see **D3** as an example, in particular **figures 94A-D**

- Claims 50, 52, 247, 249 (reset amount of activity detected when threshold amount of activity is reached): These features are merely obvious and well-known implementations for the person skilled in the art depending on circumstances without the need of inventive skill.

- Claims 51, 248 (threshold amount is 100 steps): It is well-known in the art to adjust the threshold amount, see for example **D3** for threshold, **fig 90A(9003)**

- Claims 55-57, 62, 252-254, 259 (display rings): Known in the art. See cited passages in the search report for **D3** as an example, in particular **figures 94A-D, 126A-C, 127A-C, 128 C**

- Claims 58, 59, 60, 61, 66, 67, 255-258 , 263, 264 (inactivity timer second image/text, store and reset values): These features are merely obvious implementations for the person skilled in the art depending on circumstances without the need of inventive skill.

Article 6 PCT

10 The present application does not meet the requirements of Article 6 PCT for the following reasons:

10.1 Although claims **47, 69, 70, 71, 244, 378, 379, 389, 394** have been drafted as separate independent apparatus claims, they appear to relate effectively to the same subject-matter and to differ from each other only with regard to the definition of the subject-matter for which protection is sought and/or in respect of the terminology used for the features of that subject-matter. The aforementioned claims therefore lack conciseness and as such do not meet the requirements of Art. 6 PCT.

10.2 The term **"threshold"** first used in claim 47 is used for different technical meanings in the claims, i.e. referring to a **"threshold"** from which on movement is considered physical activity and below as inactivity as well as a personal user **"threshold"** referring to a user goal of an amount of physical

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activity wished for **(see for example 49)**. The usage of the same term for different types of thresholds is unclear and leaves the reader in doubt about the exact scope of protection sought.

Invention 3: claims: 72-115, 266-306, 380, 381, 390, 395

Apparatus and method to track two types of user physical activities further considering inactivity periods, based on sensor data.

11 Reference is made to the following documents:

D3 US 2014/244009 A1 (MESTAS ALEX [US]) 28 August 2014 (2014-08-28)

D5 US 2006/052727 A1 (PALESTRANT LAURENCE [US]) 9 March 2006 (2006-03-09)

D6 US 2013/184613 A1 (HOMSI KRISTOPHER L [US] ET AL) 18 July 2013 (2013-07-18)

12 Furthermore, the below-mentioned lack of clarity notwithstanding, the subject-matter of claims 72, 113-115, 266, 380, 381, 390, 395 is not inventive in the sense of Article 33(3) PCT, and the criteria of Article 33(1) PCT are therefore not met.

12.1 D6 discloses:

A computer-implemented method comprising:
determining, using one or more processors, that a physical activity has been performed by a user wearing an electronic device, based on activity data generated by a sensor of the electronic device **(see fig. 1A and par 0040);**

determining whether the physical activity corresponds to a first type based on a first set of criteria or whether it corresponds to a second type based on a second set of criteria **(see fig. 3(302), par 0042, 0044);**

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in response to determining that the physical activity corresponds to the first type, updating a first value, stored in a memory device, based on the activity data **see fig. 3(312), see par 0059);**

in response to determining that the physical activity corresponds to the second type, updating a second value, stored in the memory device, based on the activity data **(see fig. 3(312), furthermore the system of D6 allows for different point totals for different games/activities "The user may earn two different point totals for the two different games and a third point total for their overall energy expenditure. Some point totals may be maintained separate from an overall point total." (see par 0055));**

controlling an inactivity timer that measures a length of time that the user is inactive based on the activity data **(see par 0068),** wherein controlling the inactivity timer comprises:

resetting a value of the inactivity timer in response to determining, based on the activity data, that the user has performed a threshold amount of activity **(Par 0068 states that several non-consecutive periods of inactivity are measured. This implies that the inactivity timer can be used to add up a total inactive time as well as count each inactive period separately, i.e. reset one part of the inactivity counter every time a threshold amount of activity is measured);**

incrementing the value of an inactivity counter in response to the value of the inactivity timer reaching an inactivity threshold **(see par 0061);** and

resetting the value of the inactivity timer in response to the value of the inactivity timer reaching an inactivity threshold **(see par 0068);** and

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displaying:

indicators representative of aggregate amounts of different physical activity detected from the sensor over the period of time **(see par 0058)**

and indicators representative of the value of the inactivity counter **(see par 0068)**

12.2 Therefore the only difference between D6 and independent claim 72 is that in claim 72 the three indicators are shown on the display at the same time.

12.3 The feature of independent claim 72 to display all calculated indicators to a user on a display at one time is however well-known, also in the field of monitoring different types of physical activities of a user (see for example D3, figs. 124-130c). It is therefore obvious and straightforward for the person skilled in the art to implement this way of displaying the indicators into the system of D6 depending on user wishes and circumstances without using inventive skill.

12.4 Therefore independent claim 72 is not inventive.

12.5 The same objection as for independent claim 72 applies mutatis mutandis to independent claims 113 (additional touch display **see D6, par 0019)**, 114, 115, 266, 380, 381, 390, 395 which are therefore also not inventive.

13 Dependent claims 73-112, 267-306 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of inventive step (Art 33(3) PCT).

- Claims 73-76, 267-270 (steps, walking, running...): **D6, par 0040, 0044**

- Claims 77-81, 83-85,88, 98-106, 110, 111, 271-275, 277-279, 282, 292-300, 304, 305: These features are obvious and straightforward for the person skilled in the art to implement and do not necessitate inventive skill **(see for example D3, figs. 124-130)**

- Claims 82, 276 (calories): **see D6, par 0048-0052**

- Claims 86, 87, 280, 281 (rings, bars): Known in the art. See cited passages in the search report for **D3** as an example, in particular **figures 94A-D, 126A-C, 127A-C, 128C**

- Claims 89, 283(day): **D6, par 0059**

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- Claims 90, 284 (remotely located devices): **D6, par 0027, fig. 1A**

- Claims 91, 285 (touch display): **D6, par 0019**

- Claims 92, 286 (watch): **D6, par 0031**

- Claims 93, 287 (pausing inactivity timer): **D5, see fig. 6, "after pausing the inactivity timer updating an amount of detected activity to include the physical activity performed by the user"**

- Claims 94, 288 (user has reached threshold amount of activity): known in the art, see **D3** as an example, in particular **figures 94A-D**

- Claims 95, 289(reset amount of activity detected when threshold amount of activity is reached): These features are merely obvious implementations for the person skilled in the art depending on circumstances without the need of inventive skill.

- Claims 96, 290 (threshold amount is 100 steps): It is well-known in the art that the user may input whatever threshold amount is desired, see for example **D3 for threshold, fig 90A(9003**)

- Claims 97, 107-109, 291, 301-303 (resetting amount of activity/inactivity timer start): **D6, pars 0064, 0068**

- Claims 112, 306 (types of sensors): **D6, par 0020, 0027**

Article 6 PCT

14 The application does not meet the requirements of Article 6 PCT for the following reasons:

14.1 Although claims **72, 113, 114, 115, 266, 380, 381, 390, 395** have been drafted as separate independent apparatus claims, they appear to relate effectively to the same subject-matter and to differ from each other only with regard to the definition of the subject-matter for which protection is sought and/or in respect of the terminology used for the features of that subject-matter. The aforementioned claims therefore lack conciseness and as such do not meet the requirements of Art. 6 PCT.

14.2 The same objection as above **(see paragraph 11.2)** applies to the term **"threshold"** first used in independent claim 72 for the third invention.

14.3 The term **"inactivity"** in the third invention first used in independent claim 72 is very unclear and does not allow the reader to deduce the exact technical meaning of it.

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The same objection also applies to the **"resetting"** first used in independent claim 72.

Invention 4: claims: 116-135, 307-323, 382, 383, 391, 396

Apparatus and method to track three types of user physical activity and display of the three activities, based on sensor data.

15 Reference is made to the following documents:

D7 US 2013/106684 A1 (WEAST AARON B [US] ET AL) 2 May 2013 (2013-05-02)

16 The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claims 116, 133-135, 307, 382, 383, 391, 396 is not new in the sense of Article 33(2) PCT.

16.1 D7 discloses:

A computer-implemented method comprising:
at one or more processors of an electronic device:
displaying an activity indicator, wherein the activity indicator comprises **(see par 0371-0373) :**
a first indicator representative of an aggregate amount of a first type of physical activity performed by a user over a period of time **(see fig. 124 C BIKE 130);**
a second indicator representative of an aggregate amount of a second type of physical activity performed by the user over a period of time**(see fig. 124 C RUN 243);** and
a third indicator representative of an aggregate amount of a third type of physical activity performed by the user over a period of time **(see fig. 124 C WALK 527);**
receiving, from a sensor of the electronic device, activity data representing movement associated with the electronic device **(see par 0370);** and
updating the aggregate amount of the first type of physical activity, the aggregate amount of the second type of physical activity, and the aggregate amount of the third type of physical activity based on the activity data **(see fig. 124 C, par 0373).**

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16.2 Therefore independent claim 116 is not new.

16.3 The same reasoning applies mutatis mutandis to independent claims 133 (additionally: touch sensitive display **par 0222)**, 134, 135, 307, 382, 383, 391, 396 which are therefore also not considered new.

17 Dependent claims 117, 118, 121, 129, 130-132, 308, 309, 312, 320-323 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty (Art 33(2) PCT).

- Claims 117-118, 308, 309 (aggregates of calories, minutes spent): **see fig. 130C, 126C**

- Claims 121, 312 (day): **see fig. 124 C**

- Claims 130, 131, 132, 321-323 (updating the aggregates): **implicitly disclosed in figs. 124-130**

- Claims 129, 320 (concentric ring display): **see fig. 126 C**

18 Dependent claims 119, 120, 122-128, 310, 311, 313-319 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of inventive step (Art. 33(3) PCT).

- Claims 119, 120, 128, 310, 311, 319 (display types): These features are well-known display options that the person skilled in the art would implement without the exercising inventive activity.

- Claims 122-127, 313-318: As far as these claims can be understood they refer to commonplace features the person skilled in the art would implement according to circumstances without exercising inventive activity.

Article 6 PCT

19 The application does not fulfil the requirements of Article 6 PCT for the following reasons:

19.1 Although claims **116, 133, 134, 135, 307, 382, 383, 391, 396** have been drafted as separate independent apparatus claims, they appear to relate effectively to the same subject-matter and to differ from each other only with regard to the definition of the subject-matter for which protection is sought and/

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or in respect of the terminology used for the features of that subject-matter. The aforementioned claims therefore lack conciseness and as such do not meet the requirements of Art. 6 PCT.

19.2 The definition of the term **"set of criteria"** first used in claims 122-126, 313-318 are very unclear and do not allow the reader to deduce the exact technical meaning associated with them.

Invention 5: claims: 136-198, 324-353, 384, 385, 392, 397

Apparatus and method to assist a user in setting fitness goals.

20 Reference is made to the following documents:

D3 US 2014/244009 A1 (MESTAS ALEX [US]) 28 August 2014 (2014-08-28)

D8 US 2011/261079 A1 (INGRASSIA JR MICHAEL [US] ET AL) 27 October 2011 (2011-10-27)

21 The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claims 136, 167, 197, 198, 324, 384, 385, 392, 397 is not new in the sense of Article 33(2) PCT.

21.1 D8 discloses:

An electronic device **(see fig. 1)** comprising:

one or more activity sensors configured to detect movement associated with the electronic device and generate activity data based on the detected movement **(see fig. 1 (110), par 0034, 0035);**

a display **(par 0029);**

a non-transitory computer readable storage medium comprising instructions **(see par 0029)** for:

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receiving an identification of a type of workout to be performed, wherein the type of workout is associated with a plurality of workout attributes **(see par 0039, 0040);**

receiving a goal for the type of workout, wherein the goal comprises an identification of a first workout attribute of the plurality of workout attributes and a goal value for the first workout attribute **(see par 0058);**

determining a current value of the first workout attribute and a current value of a second workout attribute of the plurality of workout attributes based on activity data from at least a portion of the one or more activity sensors **(see par 0052, fig. 8);**

displaying **(see fig. 9):**

a display of a first indicator representative of the current value of the first workout attribute relative to the goal value for the first workout attribute **(see par 0052, 0054);** and

a display of a second indicator representative of the current value of the second workout attribute **(see par 0052, fig 8);** and

one or more processors operatively coupled to the one or more activity sensors, the non-transitory computer readable storage medium, and the display, wherein the one or more processors are capable of executing the instructions of the non-transitory computer-readable storage medium **(see par 0029, fig. 1).**

21.2 Therefore independent claim 136 is not new.

21.3 The same reasoning as for independent claim 136 applies mutatis mutandis to independent claims 167, 197 (additionally with a touch-sensitive display, **see par 0032 of D8)**, 198,324, 384, 385, 392 and 397.

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22 Dependent claims 137, 140, 144-154, 158-163, 168, 171, 175-185, 189-193, 325, 328, 332-342, 346-350 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty (Art 33(2) PCT).

- Claims 137, 140, 168, 171, 325, 328 (selection of workout type): **see figs. 2, 3**

- Claims 144, 175, 332 (sensor types): **see pars 0034-0036**

- Claims 145, 146, 176, 177, 333, 334 (adjust goal value): **see par 0027**

- Claims 147, 178, 335 (run, walk, ...): **see par 0038**

- Claims 148, 179, 336 (distance, pace, calories...): **see par 0056**

- Claims 149-154, 162, 180-185, 193, 337-342, 350 (display of goal achievement, workout attributes): **see figs. 4, 6-8, 10**

- Claims 158, 159, 189, 190, 346, 347 (display with previous performances)**: see fig. 8, par 0053**

- Claims 160, 191, 348 (activation of sensors): **see par 0041**

- Claims 161, 192, 349 (update display) : **see par 0062, 0063**

- Claims 163 (watch): **see par 0046**

23 Dependent claims 138, 139,141-143, 155-157, 164-166, 169, 170, 172-174, 186-188, 194-196, 326, 327, 329-331, 343-345, 351-353 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of inventive step (Art. 33(3) PCT).

- Claims 138-139, 141-143, 156, 157, 169, 170, 172-174, 187, 188, 326, 327, 329-331, 344, 345 (display): These are merely well-known option of several straightforward well-known display possibilities for the person skilled in the art

- Claims 155, 186, 343 : As far as these claims can be understood they refer to commonplace features the person skilled in the art would implement according to circumstances without exercising inventive activity.

- Claims 164-166, 194-196, 351-353 (reward display, share): It is well-known in the art to display reward messages, share them with contacts, have contacts with profile images **(see D3, fig. 116, 136A-C, par 0336, 0360)**.

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24 The current application does not meet the requirements of Art. 6 PCT for the following reasons:

24.1 Although claims 136, 167, 197, 198, 324, 384, 385, 392 and 397 have been drafted as separate independent apparatus claims, they appear to relate effectively to the same subject-matter and to differ from each other only with regard to the definition of the subject-matter for which protection is sought and/ or in respect of the terminology used for the features of that subject-matter. The aforementioned claims therefore lack conciseness and as such do not meet the requirements of Art. 6 PCT.

24.2 The term **"workout attribute"** first used in independent claim 136 is unclear and vague and a clear technical meaning cannot be deduced from it.

24.3 There is no clear technical distinction that can be made between claims 145 and 146 and claims 176, 177,333 and 334 merely the wording is different. Therefore unclarity is introduced as it is not clear what the difference in the sought scope of protection of these claims is.

24.4 The meaning of dependent claims 155, 186, 343 to **"updating the display of the time indicator to represent a time other than the current time in response to receiving a selection of the time indicator"** is very unclear does not allow the reader to clearly deduce the scope of protection sought by this claim.

Re Item VIII

Certain observations on the international application

25 To mee the requirements of Rule 6.3(b) PCT, the independent claims should be in the two part form, with those features which in combination are part of the closest prior art being placed in the preamble.

26 The relevant prior art should be identified in the description (Rule 5.1(a)(ii) PCT).

27 It is further noted that, under certain jurisdictions, computer storage medium (storing computer programs) are considered computer programs "as such" and therefore excluded from patentability.

28 To mee the requirements of Rule 6.3(b) PCT, the independent claims should be in the two part form, with those features which in combination are part of the closest prior art being placed in the preamble.

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29 The description should be brought into conformity with the claims (Rule 5.1 (a)(ii)(iii)PCT).

30 The relevant prior art should be identified in the description (Rule 5.1(a)(ii) PCT).

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Application Number:	14599424
International Application Number:	
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Title of Invention:	WELLNESS AGGREGATOR
First Named Inventor/Applicant Name:	Christopher D. Soli
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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	IDS-10684-21300-31.pdf	682419 a55b6e455293dda92068322841b09676856533cf	no	3
Warnings:					

Information:					
This is not an USPTO supplied IDS fillable form					
2	Foreign Reference	EP_2025368_A2.pdf	4070220 3498901f2364809a2f54cb4bc0364adf658ebf64	no	97
Warnings:					
Information:					
3	Non Patent Literature	PA201570666_DKOA_06_27_2016.pdf	187119 190f6e5730ad368758912cff58ba98c638f0bd36	no	4
Warnings:					
Information:					
4	Non Patent Literature	PCTUS2013073195_IPRP_06_07_2016.pdf	367993 fe4d640005695375cf4d48382e47fa93ce82b489	no	9
Warnings:					
Information:					
5	Non Patent Literature	PA201570668_DKOA_04_08_2016.pdf	1520727 8bef30da5431947c8f6008d3c441a60f6d98d121	no	8
Warnings:					
Information:					
6	Non Patent Literature	PCTUS2015047282_ISRWO_05_09_2016.pdf	1565255 02ce9d8adae7d032f985c3a3f38ae6053afeb1df	no	33
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		Total Files Size (in bytes):	8393733		

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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	14/599,424
	Filing Date	2015-01-16
	First Named Inventor	Christopher D. SOLI
	Art Unit	3626
	Examiner Name	R. W. Morgan
	Attorney Docket Number	106842130031 (P23397US3)

U.S. PATENTS

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2]	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines, where Relevant Passages or Relevant Figures Appear	T[5]
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	1.	Non Final Office Action received for U.S. Patent Application No. 14/839,916, mailed on February 04, 2016, 19 pages.	
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[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	Examiner Name	R. W. Morgan
	Attorney Docket Number	106842130031 (P23397US3)

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

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SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Jordan Lofdahl/	Date (YYYY-MM-DD)	2016-04-05
Name/Print	Jordan M. Lofdahl	Registration Number	59,163

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(54) Title: PATIENT DATA ACQUISITION UNIT AND DATA SUPPORT SYSTEM

(57) Abstract

A system for collecting patient data from patients featuring at least one mobile computing device, such as personal digital assistant (PDA) unit, that stores data representing predetermined medical forms to be populated with information collected from patients via the personal digital assistant (PDA) unit and at least one supporting application server. The PDA unit stores a software program to be executed by the processor to facilitate patient data entry in accordance with a predetermined medical form. The PDA unit is capable of connecting to a supporting application server via modem or through direct connection or indirectly through a computer network. The application server maintains and organizes scheduling information for both patients and their assigned healthcare professionals, contains data representing predetermined medical forms to be populated with patient health status information obtained via the personal digital assistant unit, and receives, formats, and preserves the data for export and use by other data processing systems.

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PATIENT DATA ACQUISITION UNIT AND DATA SUPPORT SYSTEM

RELATED APPLICATION

This application claims priority to U.S. Provisional Application No. 60/075,002, filed February 17, 1998, entitled "Data Collection Unit for Medical Practitioners" and to U.S. Provisional Application No. 60/093,128 filed July 16, 1998, entitled "Patent Data Acquisition and Support System for Nurses."

FIELD OF THE INVENTION

The present invention is directed to the collection of patient data, and more particularly to a patient data acquisition unit and data support system.

BACKGROUND OF THE INVENTION

There is an ever increasing need to automate the collection of patient data in the health care industry. This is true whether the data is collected from patients in hospitals or patients under home health care. Home health care, however, is a growing industry where automation has not occurred as rapidly as needed.

Services being provided in the patients' home range from monitoring patient conditions during recovery from hospital care to continuous monitoring by an in-home nurse or aide. Patient data collection is necessary to monitor long term trends in patient status as well as to facilitate the practice of physicians and nursing staff. It is also useful for billing purposes.

Up until recently, all data collection has been accomplished through the use of paper medical forms which are manually filled out during or after the visit by the visiting nurse or aide. There has been an effort made to improve the accuracy and legibility of the patient data. Personal laptop computers are being considered as a data collection tool. However, personal laptop computers are still fairly expensive and too large for light and portable applications. In addition, many patients find them intimidating and obtrusive.

What is needed is a system by which a small inexpensive electronic data collection tool can be used in the field to help automate data collection of patient status.

SUMMARY OF THE INVENTION

Briefly, the present invention is directed to a system for collecting health data from patients. The system comprises mobile computing devices which can be connected to one or more supporting computing devices to achieve the exchange of information between them. In its simplest configuration, the system consists of at least one personal digital assistant (PDA) unit that interfaces with at least one application server processor. The PDA is a mobile processor containing a program for acquiring data from patients using a suite of sensors, audible input, and/or manual input. The application server is used to transmit visit schedules to the PDA, recover patient data from the PDA following visits, and to store patient health data obtained from the PDAs. This minimum system will usually be expanded by adding additional database and communication servers in a networked architecture to support a plurality of PDAs.

The PDA unit comprises a processor and a memory and stores a software program which is executed by the processor to facilitate patient data entry in accordance with a predetermined medical form. The PDA unit is capable of connecting to the application server via direct connection or through a modem. The application server transmits data representing the predetermined medical forms to the PDA unit and receives from the PDA unit data representing populated medical forms. These data are typically processed further in preparation for their transmission to a larger patient records database.

In addition, the present invention is directed to the combination of a PDA and a sensor interface that connects with one or more patient data sensors for collecting health status information from the patient and automatically populating the medical forms in the personal digital assistant with the acquired data.

Other objects and advantages of the present invention will become more readily apparent when reference is made to the following description taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a block diagram of a system for collecting patient data according to the present invention.

Figure 2 is a block diagram of a personal digital assistant unit and a sensor interface according to one embodiment of the present invention.

Figure 3 is a block diagram of one embodiment the sensor interface.

Figure 4 is a flow chart showing the general operation of the system according to the present invention.

Figure 5 is a flow chart showing the method by which patient data information is collected by a personal digital assistant unit according to the present invention.

Figures 6-15 are sample screens displayed on the personal digital assistant unit to prompt attending personnel to enter data to be populated into a medical form.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Referring first to Figure 1, the patient data acquisition or collection system according to the present invention is shown generally at reference numeral 10. The system 10 comprises one or more mobile computing devices, such as personal digital assistants (PDAs) 20, and an application server 30. Connection of the application server 30 through a network 60 with other computer resources such as a communication server 50 and/or a database server 80 are typical approaches to expanding the system to handle a larger number of patients. The functions of the application server 30 and the database server 80 may reside in the same physical machine, or they may be distributed (as shown in Figure 1) as appropriate to the processing load anticipated for the system 10. The database server 80 organizes and maintains the collected patient medical information.

The PDA 20 is a well known piece of hardware that is capable of performing a variety of tasks. For example, the PDA 20 is PalmPilot™ PDA sold by 3Com Corporation, or a MobilePro™ PDA, sold by NEC. The PDA 20 receives software application functionalities from the application server 30. Other similar mobile computing devices are also suitable for use in accordance with the present invention.

Depending on the make and model of the PDA 20, it interfaces with the application server 30 through a cradle interface 40, by telephonic connection via an internal or external modem (not shown) over a telephone network 70, or via a standard serial interface cable (not shown). These interfaces are well known in the art and therefore are not shown or described herein. The software applications that manage the downloading of new applications or new data to the PDA 20 reside in application server 30. As is known in the art, new software applications or new data are installed in the PDA 20 when the PDA 20 is connected to the application server 30 and a "synchronization" operation is initiated. Similarly, data collected and stored in the PDA 20 are downloaded to the application server 30 during a "synchronization" operation. Some PDAs 20 have the capability to support certain downloading functions whereby only specific data can be designated for exchange between the PDA 20 and the application server 30.

Some PDAs 20 have built in keyboards, while others, such as the PalmPilot™ PDA have a graphical user interface which includes handwriting or speech recognition software to facilitate manual or voice data entry, respectfully. In addition, the PDA 20 has a display (not shown) that can present information in black-white or color. Text may be entered by writing directly onto a digitizer tablet that overlies the display or which may be separate from it. In accordance with the present invention, the functionality of the PDA 20 is refocused from its use as a personal contact manager/scheduler to the specific needs of the health care industry.

The application server 30 is a computer that stores (in an internal memory or hard disk) data representing one or more predetermined medical forms to be populated with information from a plurality of patients. These forms may be changed from time-to-time. For example, a typical medical form may be one of the Outcome and Assessment Information Set (OASIS) forms or what is commonly referred to as Nurses Notes, from a patient visit. Information that is collected by the one or more PDAs 20 is ultimately stored in one or more databases which themselves, may reside on other dedicated computers.

The network 60 may be any standard computer network known in the art, such as an Ethernet™ network for use internally by a hospital or home health care business.

Moreover, the network 60 could encompass data networks external to business, such as the Internet/World Wide Web.

Turning to Figure 2, a PDA 20 is shown together with a sensor interface/signal processor device 100 according to an alternative embodiment of the present invention. The sensor interface 100 connects to one or more patient data sensors 110 attached in, on or about the patient. Examples of sensors to which the sensor interface attaches are a temperature sensor, pulse/blood pressure sensor, blood glucose sensor, electronic scale, respiration monitor, etc. It is envisioned that as technologies develop, the sensor interface 100 may read data from microscopic in-body sensors in which a variety of medical information is derived from very small samples of a patient's biological fluids or tissues, or indirectly from other physical phenomena associated with the patient's body. The sensor interface 100 affords the ability to automatically read patient data sensors rather than requiring that the data be manually entered into the PDA 20.

An electrical block diagram for the sensor interface 100 is shown in Figure 3. Generally, the sensor interface 100 includes the ability to convert an analog output signal from a sensor to a digital signal suitable for storage by the PDA 20. For example, typical temperature sensors and blood pressure/pulse sensors may provide an analog output signal, while other sensors may provide a digital output. For those sensors that generate an analog output, one or several analog signal processor circuits 120 are provided to condition the analog output. An analog-to-digital converter (ADC) 130 converts the conditioned analog output to a digital signal. A digital data processor 140 connected to the ADC 130 processes the digital signal(s) representing the analog sensor output and organizes the information into a suitable data packet to be uploaded into a host device from the PDA 20. The sensor interface 100 may be powered by the PDA 20, or by an internal battery power conditioning supply 150. The sensor interface 100 connects to the PDA 20 by a standard cable, such as an RS-232 digital serial interface cable. The sensor interface 100 connects to the sensors 110 either by hardwire connection or by a wireless link via antenna 112. If a wireless link is employed the sensor interface 100 and sensors 110 would include suitable transmission and reception circuitry 160.

Reference is now made to Figure 4, in conjunction with Figures 1-3, for a description of the operation of the PDA 20 and the patient data acquisition system 10 in general. In Figure 4, the application server 30 is referred to as the "MediFORM Application Processor." In step 300, patient schedules are entered into the application server 30 either manually or through a network accessible external computer that contains and updates patient schedule information. Next, in step 310, the application server 30 allocates attending personnel (nurses, nurse/aides, doctors, etc.) in accordance with the patient visitation schedule. Then, in step 320, the data representing the medical form(s) is downloaded from the application server 30 to PDAs 20 via the cradle interface 40, telephone network 70, etc. Typically, these data are used to generate one or more forms which are presented on the PDA 20 display to guide the user through the data collection process.

In step 330, the user of the PDA 20 enters the data (either manually, electronically or audibly) into the PDA 20 at the patient site. This process will be described in greater detail hereinafter in conjunction with Figure 5. The information that is downloaded to a PDA 20 may include instructions for the nurse or aide to collect data from a plurality of specified patients.

Once all of the data from a patient or patients are collected, in step 340, the PDA is coupled to the application server 30 to upload data representing the populated medical forms. Alternatively, the data may be uploaded via telephone network 70. The data are uploaded from the PDA 20 to the application server 30 where it is processed in step 350 and formatted for storage in a database. The processing described in this step may be as simple as converging data from several reports into a permanent patient record or may involve the conversion from one database format to another in order to interface with the existing databases of a healthcare provider.

Finally, in step 360 the data, now properly formatted representing the populated medical forms, are transferred to the database server 80 for storage.

Turning now to Figure 5, the manner in which the patient data are collected and entered into the PDA 20 (step 330 of Figure 4) will be described. If the PDA 20 supports only manual data entry in step 332, then in step 334, the user enters data into the PDA through standard PDA user interfaces (keyboard, handwriting or speech recognition, etc.). On the other hand, if the PDA 20 is augmented to support

electronic and automatic data collection and entry via sensor interface 100, then in step 336, the sensor interface 100 is connected to the patient data sensors 110. Then, by initiating a procedure on the PDA 20, the sensor interface 100 triggers activation of the various patient sensors (if necessary) to obtain a reading of the related information, such as blood pressure/pulse rate, temperature, etc. Once the patient data sensors 110 make the information available, the sensor interface 100 reads the information from them, converts and/or processes the information as appropriate and uploads the information to the PDA 20. The PDA 20 receives the information and automatically populates the medical form for the patient.

Reference is now made to Figures 6-15 in which examples of the screens displayed on a typical PDA 20 are shown. Each screen includes icons or graphical button elements that can be selected by the user (with a stylus or some other means) to move to another screen containing additional information or data entry prompts.

Figure 6 illustrates an initial screen having two buttons: VISIT REPORT and VITAL STATISTICS. When the VISIT REPORT button is selected, the screen shown in Figure 7 is displayed. The screen in Figure 7 includes prompts to enter basic information about the particular patient and patient site being visited. This information is self explanatory. When all of this information is entered, the user selects the DONE button.

When the VITAL STATISTICS button is selected, the screen shown in Figure 8 is displayed. The VITAL STATISTICS screen includes data entry prompts for entering temperature, pulse rate, respiration, blood pressure, weight, and last bowel movement. All of this information may be entered manually, or as explained above, it may be entered electronically via the sensor interface 100. Another set of screens may be displayed to enter a variety of patient care information. These screens are shown in Figures 9-14, and are self-explanatory. The screens shown in Figures 9-14 are exemplary and in no way limit the expansion of these concepts to include other patient related information.

The last screen shown in Figure 15 is a general entry screen where general comments can be entered by the attending personnel into the PDA 20 using the PDA's text and speech recognition capabilities.

In summary, the present invention is directed to a method of acquiring health data from patients comprising steps of: generating information representing a medical form to be populated with patient data collected from a plurality of patients; storing the information representing the medical form in a mobile computing device, such as portable digital assistant (PDA) unit; collecting patient health data from patients, inputting the patient health data into the PDA, and populating a medical form in the PDA unit with patient health data collected for each patient; and uploading data representing populated medical forms from the PDA unit to a database for storage therein. The information representing the medical form may initially reside on an application server, and the PDA unit receives the information over a communication network during a "synchronization" procedure or other dedicated downloading procedure.

Similarly, the present invention is directed to a system for collecting patient data from patients, comprising: a network supporting communication and exchange of information between devices connected thereto; an application server connected to the network that stores data representing a predetermined medical form to be populated with information collected from patients and for storage in a database; and at least one mobile computing device, such as a personal digital assistant (PDA) unit, comprising a processor and a memory, the memory of the PDA unit storing a software program and information representing the predetermined medical form received from the application server, the processor of the PDA unit executing the software program to populate the predetermined medical form with patient health data received as input to the PDA unit.

Finally, the present invention also is directed to the combination of a mobile computing device, such as a personal digital assistant (PDA) unit, and a sensor interface. The PDA unit comprises a processor and a memory, the memory of the PDA unit storing a software program and information representing a predetermined medical form received from the application server, the processor of the PDA unit executing the software program to populate the predetermined medical form with patient health data received as input to the PDA unit. The sensor interface receives the patient health data from one or more sensors attached to, implanted in or which otherwise derive information from the patient's body, wherein the PDA unit receives

the patient health data from the sensor interface and automatically populates the medical form in the PDA unit with the patient health data.

The foregoing description is intended by way of example only and is not intended to limit the present invention in any way except as set forth in the following claims.

What is claimed is:

1. A system for collecting patient data from patients, comprising:

a network supporting communication and exchange of information between devices connected thereto;

an application server connected to the network that stores data representing a predetermined medical form to be populated with information collected from patients and for storage in a database; and

at least one mobile computing device comprising a processor and a memory, the memory of the mobile computing device storing a software program and information representing the predetermined medical form received from the application server, the processor of the mobile computing device executing the software program to populate the predetermined medical form with patient health data received as input to the mobile computing device.

2. The system of claim 1, and further comprising a sensor interface that electrically connects to one or more patient data sensors for collecting patient data from the patient data sensors and automatically populating the medical forms in the mobile computing device with patient data sensor information.

3. The system of claim 1, and further comprising a database server connected to the network that supports and maintains the database of collected information.

4. The system of claim 1, wherein the mobile computing device is a personal digital assistant (PDA) unit.

5. A method for acquiring health data from patients comprising steps of:

generating information representing a medical form to be populated with patient data collected from a plurality of patients;

storing the information representing the medical form in a processor server;

downloading the information representing the medical form to a portable digital assistant mobile computing device;

collecting patient health data from patients, inputting the patient health data into the mobile computing device, and populating a medical form in the mobile computing device with patient health data collected for each patient; and

uploading data representing populated medical forms from the mobile computing device to a database for storage therein.

6. The method of claim 5, wherein the step of collecting patient data comprises manually or audibly entering patient data observed by an attending personnel into the mobile computing device.

7. The method of claim 5, wherein the step of manually entering comprises displaying a plurality of screens each representing a subset of queries for types of patient data to be manually or audibly entered by the attending personnel.

8. The method of claim 5, wherein the step of collecting comprises connecting a sensor interface to the mobile computing device and to one or more patient data sensors, electronically reading the patient data sensors, uploading patient data sensor information into the mobile computing device.

9. The method of claim 8, and further comprising the step of automatically populating the medical form in the mobile computing device with data collected from the patient data sensors.

10. In combination, a mobile computing device comprising a processor and a memory, the memory of the mobile computing device storing a software program and information representing a predetermined medical form received from the application server, the processor of the mobile computing device executing the software program to populate the predetermined medical form with patient health data received as input to the mobile computing device, and a sensor interface that receives patient health data from one or more sensors attached to, implanted in or which

otherwise derive information from the patient's body, wherein the mobile computing device receives the patient health data from the sensor interface and automatically populates a medical form stored in the mobile computing device with the patient health data.

11. A method of acquiring health data from patients comprising steps of:

generating information representing a medical form to be populated with patient data collected from a plurality of patients;

storing the information representing the medical form in a portable digital assistant (PDA) unit;

collecting patient health data from patients, inputting the patient health data into the PDA, and populating a medical form in the PDA unit with patient health data collected for each patient; and

uploading data representing populated medical forms from the PDA unit to a database for storage therein.

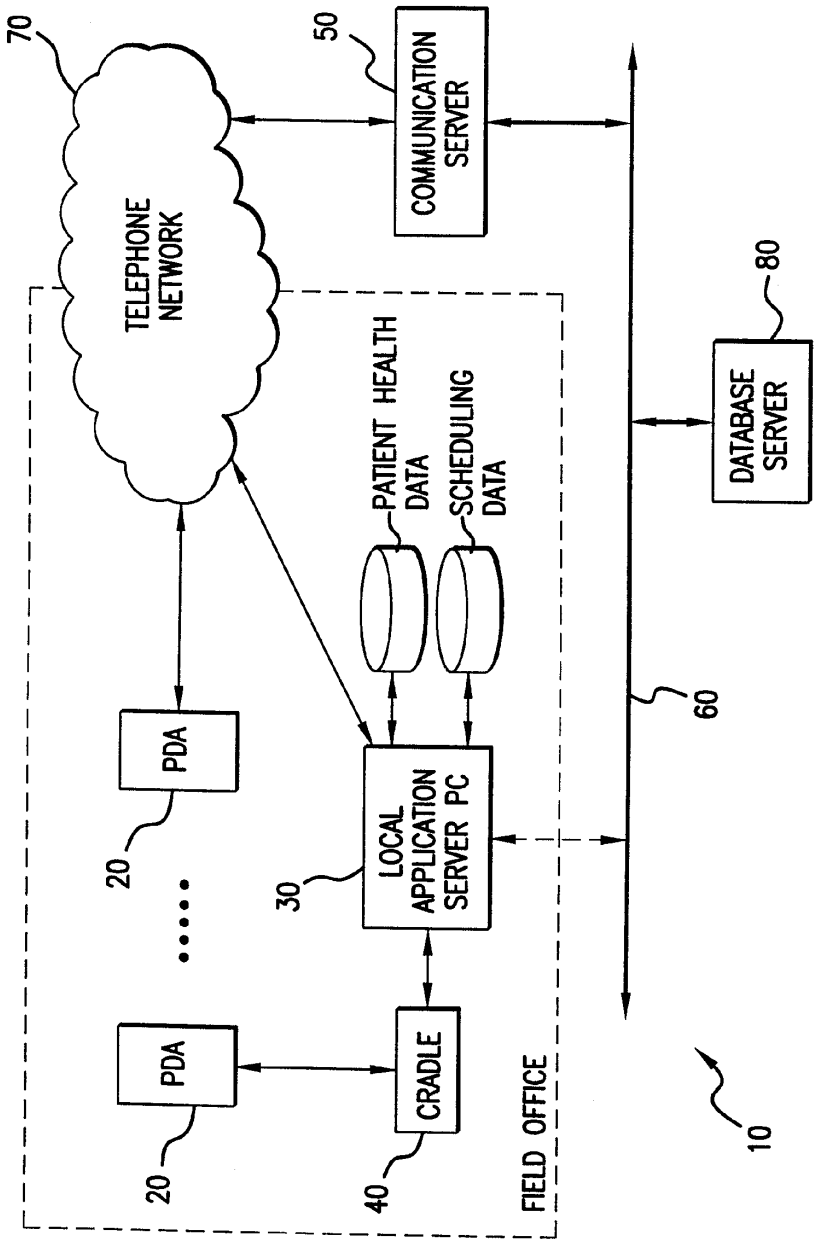


FIG. 1

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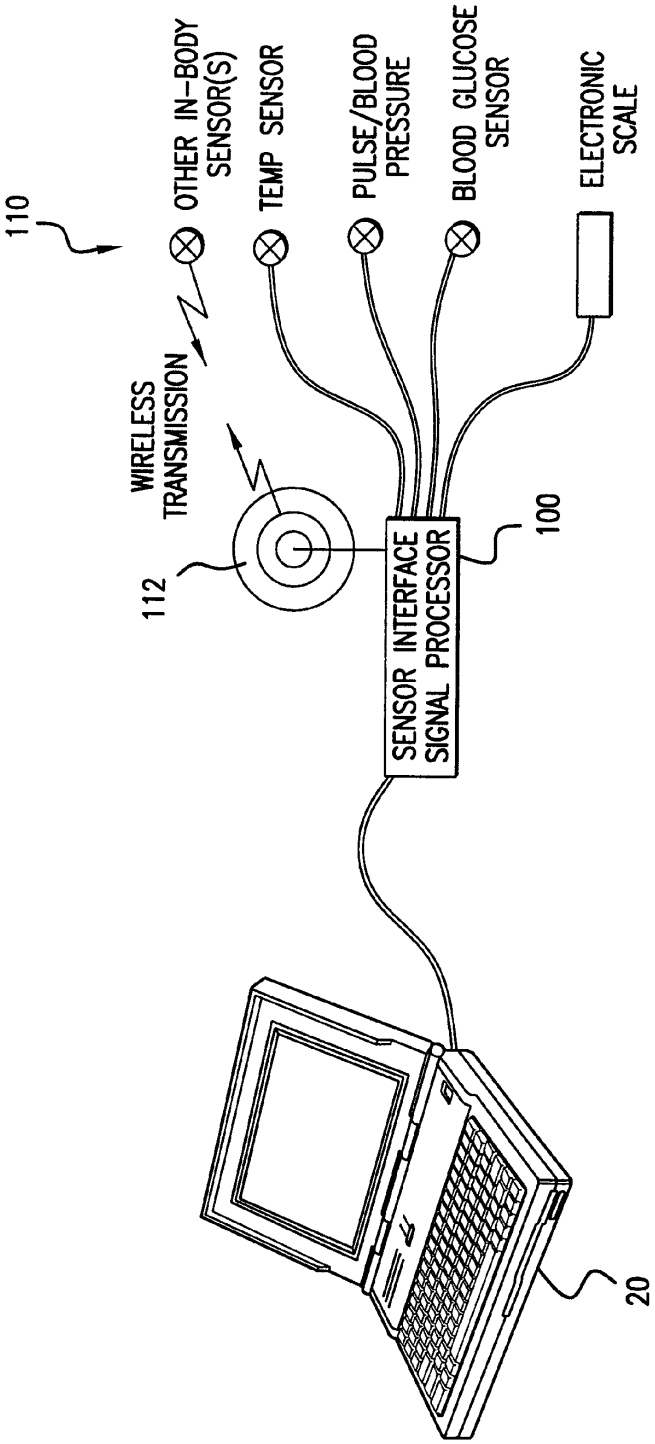


FIG.2

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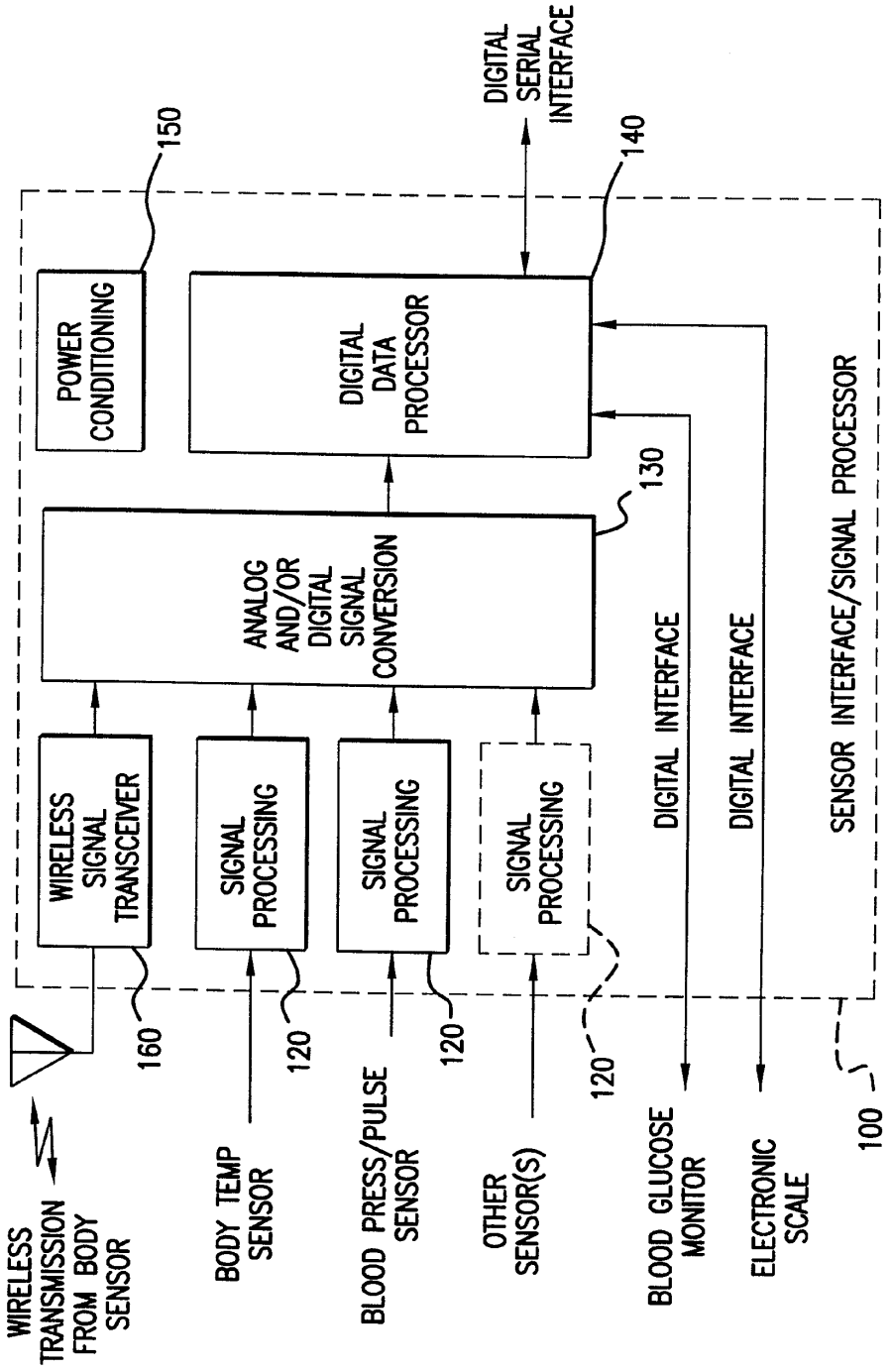


FIG.3

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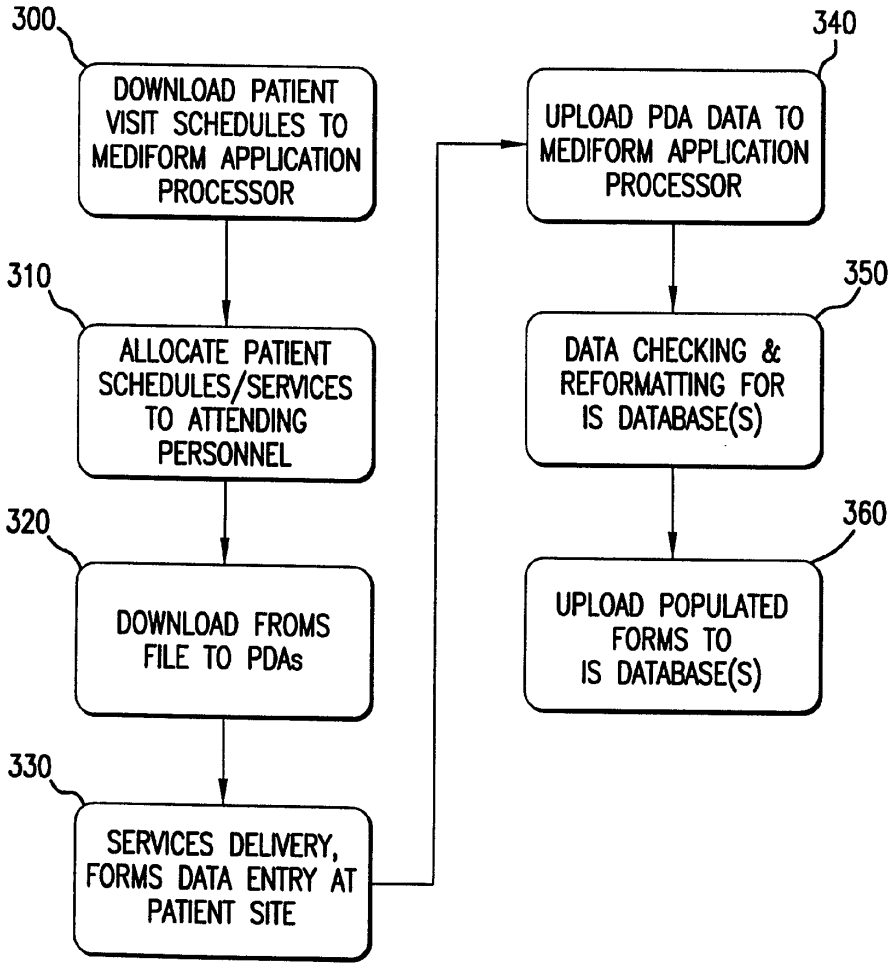


FIG.4

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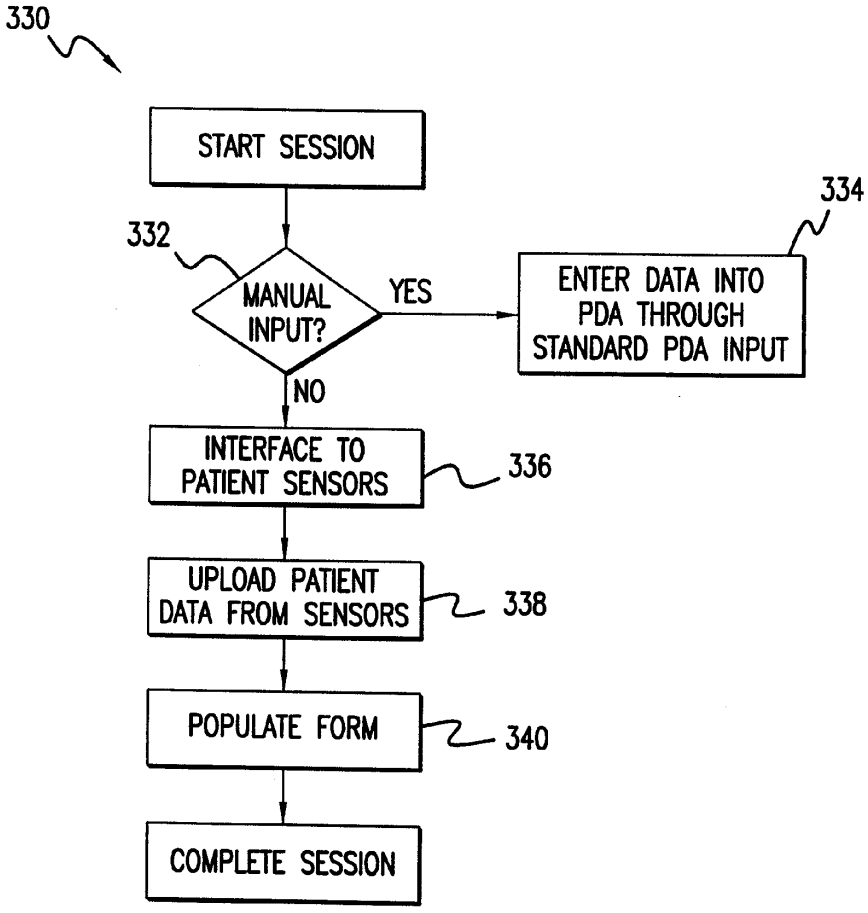


FIG.5

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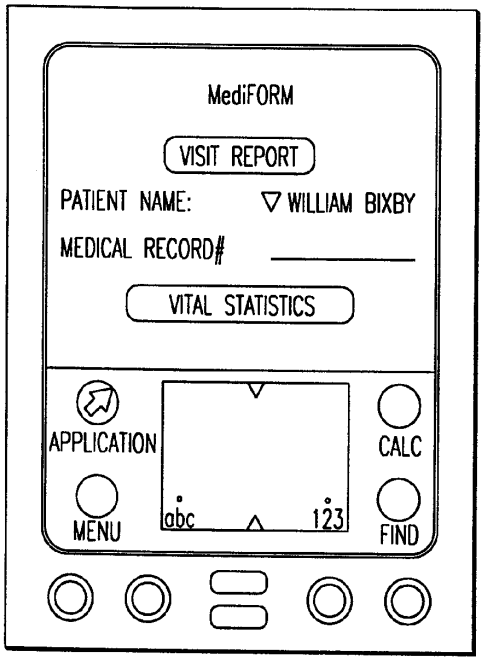


FIG.6

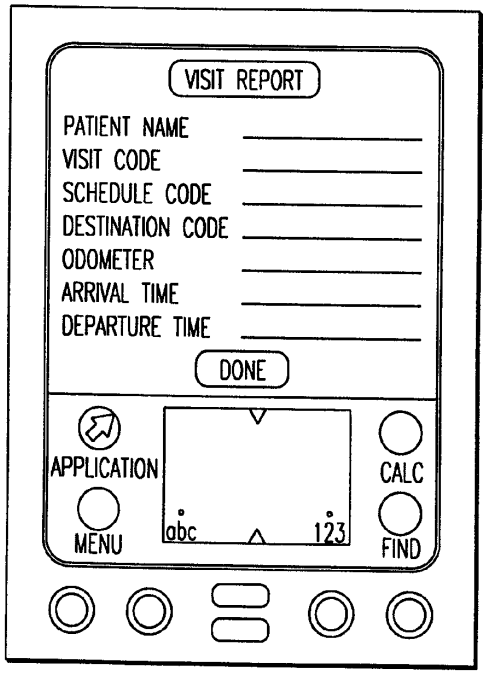


FIG.7

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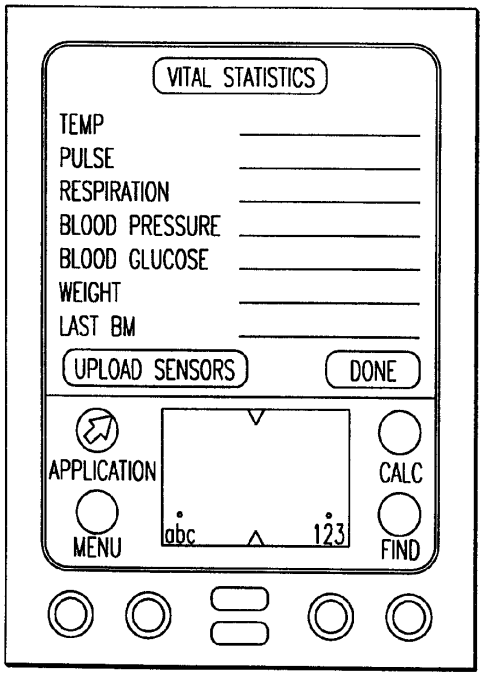


FIG.8

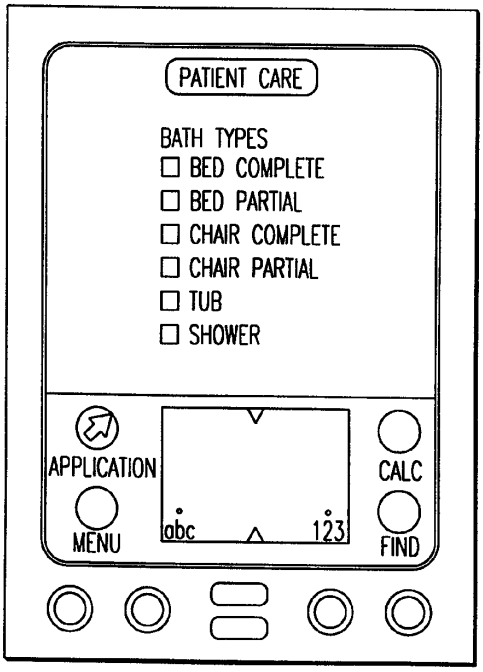


FIG.9

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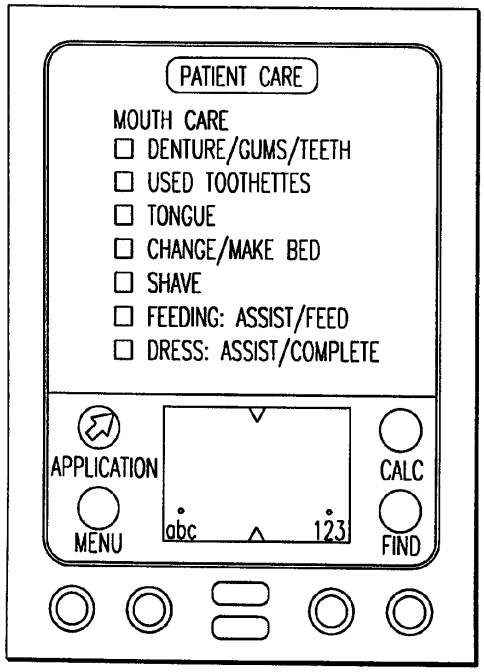


FIG.10

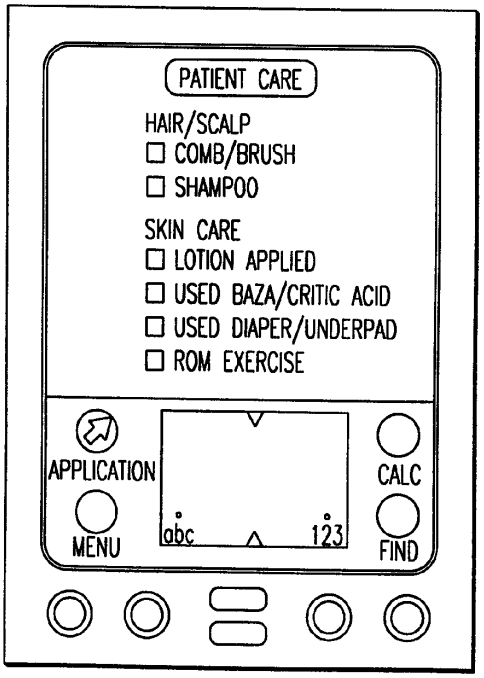


FIG.11

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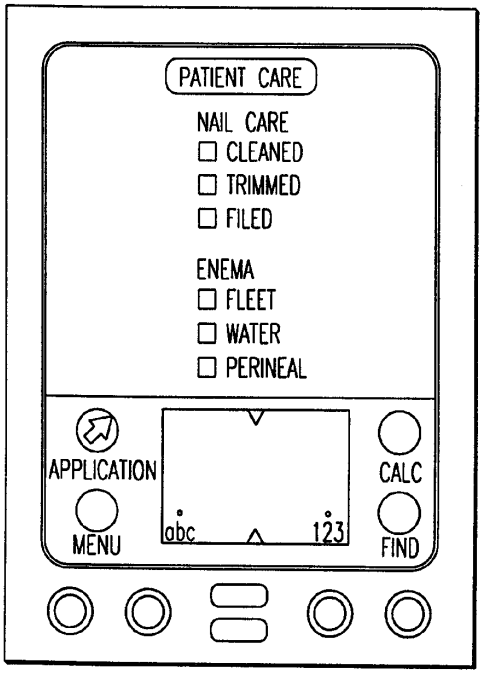


FIG.12

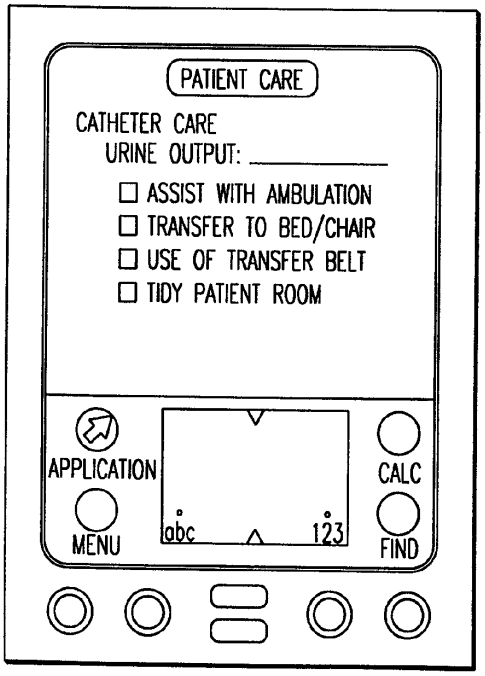


FIG.13

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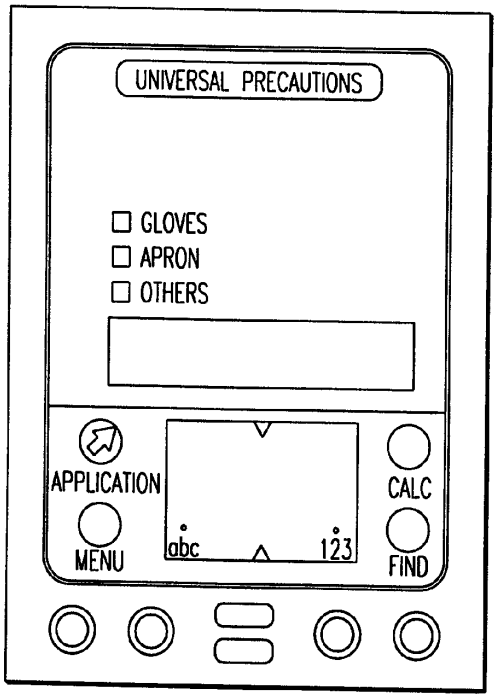


FIG.14

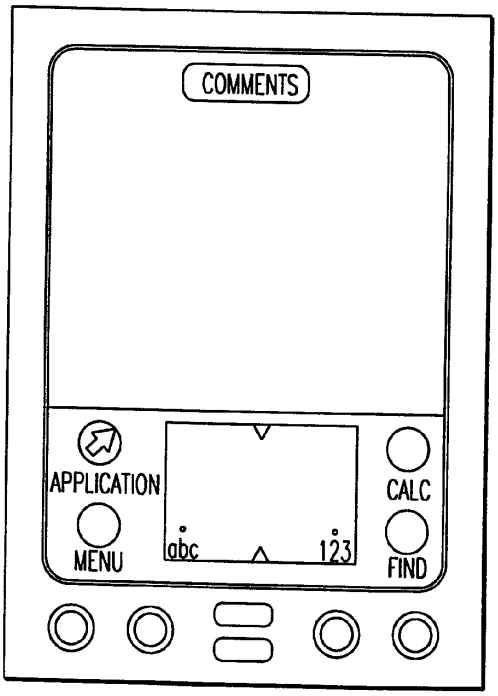


FIG.15

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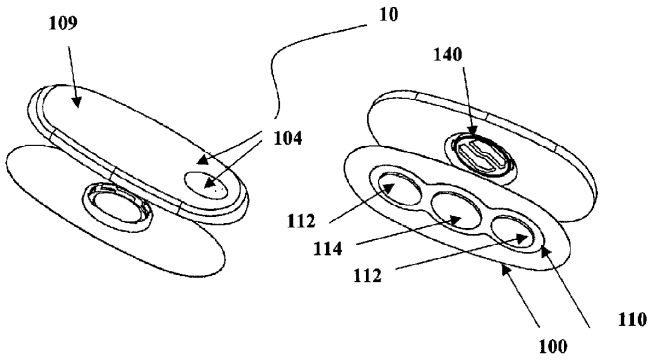
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Declaration under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE,*

[Continued on next page]

(54) Title: ADAPTIVE PHYSIOLOGICAL MONITORING SYSTEM AND METHODS OF USING THE SAME



(57) Abstract: The present invention provides methods and an apparatus for an adaptive physiological monitoring system (10). The physiological monitoring system incorporates a sensor (110) responsive to the physical activity of the monitor-wearing patient. The system monitors one or more physical parameter(s) of the user to distinguish between periods of quiet rest and normal waking activity and communicates non-urgent information regarding a system error or information about the measured physical parameter to the user or to an external system only if one or more physical parameters of the user exceed predetermined threshold criteria. The system also suppresses alerts regarding physiological states that are inconsistent with normal patient activity if one or more physical parameters of the user exceed a predetermined threshold. The physiological monitoring system (10) incorporates a sensor (110) responsive to the physical activity level of the user, for detecting directly or indirectly measuring the physical activity level of the user.

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EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW, ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)

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ADAPTIVE PHYSIOLOGICAL MONITORING SYSTEM AND METHODS OF USING THE SAME

DESCRIPTION

The present invention relates generally to the field of physiological monitoring of patients, and more particularly, to methods and an apparatus for a physiological monitoring system with an adaptive alert mechanism.

Doctors often need round-the-clock measurements of a body parameter over a period of time to make an accurate diagnosis of a condition. Vasovagal syncopal events and arrhythmias of the heart are particularly challenging to diagnose because of their relative infrequency, sudden onset and short duration. Holter monitors are one type of ambulatory physiological monitoring systems (PMS) that are used to measure the electrical signals of a patient's heart over a period of time to detect abnormalities in the heart beat of the patient. Typically, these systems continuously monitor electrocardiography (ECG) signals for a finite test period of about 24-96 hours. By reviewing the collected ECG data in an external monitoring device, doctors may identify patients who have heart arrhythmias and who are at risk for ventricular tachycardia or other cardiac conditions.

In patients who have already been diagnosed with an arrhythmic heart condition, and who are at risk for potentially life-threatening cardiac events, it is often desired to monitor their condition over the long term. It is therefore desirable that the monitoring system be capable of long term monitoring for arrhythmic events and adequately capture such events when they occur. Since the device will be worn by the patient for potentially

long durations of time, it is also desirable for the device to be compact, lightweight, mechanically robust, and unobtrusive as the patient goes about his normal daily routine of activity and rest. Traditional Holter monitors are unsuitable for such long term monitoring because of their bulky profile and relatively high power consumption levels required to power the continual ECG detection and data storage.

Ambulatory ECG monitors typically include several electrodes that are attached to the patient and a processor that acquires and processes the electrical signals into data and stores the data for later analysis. If it is functioning properly, the monitoring system is able to detect and capture cardiac event data for later retrieval and analysis. In practice, however, it is often the case that the monitoring becomes interrupted because of battery-power loss, sensor detachment problems, or other system or user errors.

Existing PMS typically employ an audible or visual alarm to alert the user of any such system malfunctions or errors. Some of the malfunctions or errors that trigger the alarm require immediate user attention, such as a malfunction requiring shutdown and restart of the PMS, signal loss due to improper sensor connection(s), or electrical interference. Other errors that trigger the alarm are less urgent (e.g., low battery power). In these prior art systems, both urgent and non-urgent types of information are communicated to the user via the alarm, whether or not the user is receptive to being disturbed.

One such conventional system is described in U.S. Patent No. 6,248,067 to Causey, Kovelman, Purvis, and Mastrototaro, and assigned to MiniMed Inc., which patent is entitled "Analyte Sensor and Holter-Type Monitor System and Method of Using the Same," which is hereby incorporated by reference in its entirety. This patent describes a Holter-type recorder device equipped with a vibrator alarm or optical indicator such as a light-emitting diode (LED) that alerts the user of a system malfunction. This vibration

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alarm, if it remains unanswered by the user, provides additional reminders to an audio alarm. The drawback of this system is that the audio alarm may become triggered during periods of sleep or other inopportune times when the user cannot respond promptly.

In other systems, a user of the PMS may manually change a switch setting between audible and/or silent (e.g. tactile or visual) alarm modes to prevent undesired beeping interruptions. However, manual switching represents a suboptimal solution because the burden is on the user to constantly switch between modes as he goes about his daily routine of active and inactive periods and other instances where interruptions may not be tolerated or it is necessary to conceal the presence of the PMS.

There is a need, therefore, for an improved method and apparatus for an adaptive physiological monitor that alerts the user of events indicating a system problem or malfunction when it determines that the user is in an active waking state or otherwise receptive of receiving and responding to the alarm.

In the case of PMS systems that alarm for life-threatening arrhythmia conditions, physical activity on the part of the monitored patient has some additional implications. First, physical activity may result in signal artifact that causes the monitored physiological parameter (e.g. the ECG signal) to resemble its form when some life-threatening arrhythmias (e.g. ventricular fibrillation) are present when they are in fact absent, and may generate a false positive alarm. At the same time, physical activity above a certain level may be inconsistent with the presence of the life-threatening arrhythmia or condition, because the life-threatening condition weakens the patient or renders the patient unconscious. Thus, physical activity itself, apart from its influence on the signal quality of the monitored physiological parameter, provides significant information about the patient's

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cardiac status, and in combination with the ECG signals, provides a more complete assessment of the cardiac condition of a patient at a given time.

Accordingly, there is also a need for a knowledge-based PMS that inhibits the transmission of an alarm reflecting a life-threatening physiological event when the system detects that the patient is physically active.

The present invention solves these and other problems by providing a method and apparatus for an adaptive physiological monitoring system that differentiates between urgent and non-urgent information and then alerts the user accordingly based on a knowledge-based approach that considers the user's receptivity to responding to the information, and more generally that considers the implications of the user's level of physical activity. By transmitting information in this adaptive manner, user acceptance of the PMS is improved. The user is not disturbed during periods of rest with non-urgent information, and the incidence of false positive alarms is reduced as well.

According to one aspect of the present invention, an exemplary embodiment is a method and system for an adaptive physiological monitoring system that monitors one or more physical parameter(s) of the user to distinguish between periods of quiet rest and normal waking activity and communicates non-urgent information to the user only if one or more physical parameters of the user exceeds a predetermined threshold.

According to an embodiment of this aspect of the present invention, the physiological monitoring system incorporates a sensor responsive to the physical activity level of the user, such as an accelerometer or other mechanical, chemical, or electrical means for detecting directly or indirectly measuring the physical activity level of the user

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According to another aspect of the invention, an exemplary embodiment is a method and apparatus for a lightweight, energy-saving physiological monitoring system that conserves power by delaying transmission of non-urgent information to the patient when the patient is asleep or resting.

According to one embodiment of this aspect of the present invention, the alert information is communicated to the patient by means of a device local to the monitor, such as a vibrator or speaker.

According to another embodiment of this aspect of the present invention, the alert information is communicated to the patient by means of devices in his environment, which the monitor signals wirelessly.

According to yet another aspect of the invention, an exemplary embodiment is a method and apparatus for long term, low power ECG monitoring. By limiting the transmission of information when the patient is asleep or resting, the present invention allows for considerable savings in battery power consumption, increasing the capacity for long term monitoring of the patient.

According to yet another aspect of the invention, an exemplary embodiment is a method and apparatus for long term monitoring for life-threatening physiological events. By inhibiting the transmission of alarms reflecting the appearance of a life-threatening pattern in the physiological parameter being monitored when the patient is engaged in normal waking activity inconsistent with the life-threatening phenomenon, the incidence of false alarms is reduced.

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FIG 1 is a perspective view of one embodiment of the physiological monitoring system of the present invention.

FIG 2 is a pictorial view showing a physiological monitoring system (PMS) according to an embodiment of the present invention on a patient.

FIG 3 illustrates a block diagram depicting the major components of the PMS according to an exemplary embodiment of the present invention.

FIG 4 is a flow chart depicting the steps performed by the physiological monitoring system to create a feedback loop that monitors a patient's physiological parameters and alerts the patient of system errors and physiological conditions in an adaptive manner based on the detected activity level of the patient.

A more complete understanding of the method and apparatus of the present invention is available by reference to the following detailed description of the embodiments when taken in conjunction with the accompanying drawings. It is worthy to note that any reference herein to "one embodiment" or "an embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the invention. The appearances of the phrase "in one embodiment" in various places in the specification are not necessarily all referring to the same embodiment. The detailed description of the embodiments which follows is intended to illustrate but not limit the invention. The scope of the invention is defined by the appended claims.

A physiological monitoring system according to the present invention comprises an adaptive system that, in addition to monitoring a particular physical characteristic of the

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patient for medical purposes, communicates a variety of information to the user based on a knowledge-based approach that determines whether the user is physically active. If the system detects that the patient is asleep, resting, or otherwise in a non-active state, it defers the transmission of non-urgent information until it detects that the patient is in a normal active state. On the other hand, if the system detects that the patient is in a normal active state, it inhibits, as false alarms, transmission of any urgent information that is inconsistent with the patient being in a normal active state.

Briefly, the above-described adaptive monitoring is achieved by way of an internal microprocessor having sufficient logic and data analysis capabilities to independently perform all internal control functions, including acquisition of data from sensors, processing of that data, and providing appropriate instructions to various sensors and output devices. On-board memory (e.g., static read and write memory) performs control and analysis processes and selectively stores critical information regarding a cardiac episode.

FIG 1 illustrates a perspective view of an embodiment of the monitoring system for monitoring cardiac parameters in an ambulatory setting of daily activity. The system 10 comprises a monitor 100 and sensors 110 or other transducers that are connected to the monitor 100. A wireless transmitter 109, and optionally, an event button 104 are located on the monitor 100.

The monitor 100 is designed for use with one or more sensors or transducers such as electrodes 112. As will be appreciated by one of skill in the art, a variety of sensors may be employed in the practice of this invention. With sufficient hardware and connections to the body, numerous physiologic parameters may be sensed as is pointed out in U.S. Pat. No. 5,464,434 issued to Alt and U.S. Pat. No. 5,464,431, issued to Adams et

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al., which is hereby incorporated by reference in its entirety. The physical parameters may include, but are not limited to, a patient's body movements, heartbeats, respiratory movements, snoring, and other mechanical movements and sounds detected by the sensors, respiration rate and depth (by for example, impedance plethysmography), brain waves, body temperature, and blood pressure.

A plurality of sensors 110 may be employed simultaneously to measure the same or different physiological characteristics. For instance, typically two to six electrodes 112 may be employed to measure biological rhythmic signals such as heart rate in conjunction with an activity sensor 114 such as an accelerometer that measures the physical activity level of the patient. As shown in FIG 2, in one embodiment, at least one set of sensors 110 comprises ECG electrodes 112 that measure electrocardiograms and that are placed in contact with the patient's body so as to receive signals from the patient which are transmitted to the monitor 100. As is obvious to one of skill in the art, the electrodes may be conventional electrodes comprised of silver chloride or other compositions designed to receive analog ECG input. The system 10 may also comprise a set of activity sensors 114 that detect motion, movement, acceleration, mechanical vibrations, sound, or other indicator of physical activity on the part of the human subject.

The activity sensor 114 may comprise a piezoelectric pressure transducer, a pedometer, a vibratory or motion detector, a detector that measures residual noise generated by friction between the electrode contacts and the patient's skin, strain gage or other transducer means for measuring activity. In addition to an accelerometer, other sensors which measure physiological parameters which distinguish between resting and active states may be employed.

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In one mode of the invention, the activity sensor 114 is a cantilevered suspended element which constitutes a high impedance voltage generator such as a piezoelectric element. The sensors may be incorporated into the monitor module 100 itself, or placed in close proximity to the monitor. The output of the activity sensor 114 is connected to a processor 142 contained within the monitor 100. The piezoelectric element is a passive element or sensor requiring no power to cause it to be operational. The distortion of the surface of or of the element, itself, generates the appropriate signal.

The activity sensors 114 may alternatively detect chemical or electrical changes in the patient that indicate the onset of sleep. For example, in one exemplary embodiment, the activity sensor 114 is integrated within the monitor 100 unit, as shown in FIG 2, and in other embodiments, are external to the monitor 100, such as a wrist-mounted activity sensor 114 attached to a wrist with a strap that detects electromyographic (EMG) electrical impulses produced by the wearer's wrist muscles. Such electrical impulses provide measurements of the changes in the muscular activity at the wearer's wrist, which measurements are useful in detecting drowsiness. The sensors 110 are applied to the body such that the surface of the sensors makes physical and/or electrical contact with the patient.

Although the monitor 100, and thus the sensors 110 are shown applied to the chest, one of skill in the art will appreciate that various alternative sensor construction, materials, and designs are within the scope of the present invention. The information signals from these measuring devices such as the ECG electrodes 112 and activity sensors 114 are then transmitted to the monitor 100 for amplification and processing.

Referring now to FIG 3, which is a block diagram of the major elements of the monitoring system 10, the system includes the sensors 110 (sensor electrodes 112 and

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activity sensor 114), an electronics module 140, a power circuit 150, which provides power to the system 10, and may include a voltage splitter and voltage regulator in addition to a battery, an alarm 160 (acoustic alarm 162 and silent alarm such as a tactile or visual/light alarm 164), a user interface module 170, a wireless transmitter 109 or other means for communicating with an external computer, device, or medical personnel (not shown). The user interface module 170 includes an event button 104 and optionally, a user display 106 which displays status messages and system error messages to the user.

Referring now to the details of the exemplary electronics module 140 shown in block form in FIG 3, the major components of the electronic module 140 include a CPU or microprocessor 142 with an internal CPU memory 144 and an internal digital input/output circuit, signal conditioners 145, analog-to-digital converters 147, an activity threshold detector 148 input with a programmable activity level 149, and a clock 146. The microprocessor 142 performs a multitude of functions, including, but not limited to, receiving and processing signals output from the sensors 110 regarding arrhythmia conditions and checking and processing system errors. The selection and design of such circuitry and various other circuit means will be obvious to one of ordinary skill upon review of this specification.

The output of the sensors 110 such as the ECG electrodes 112 is coupled to a signal conditioning circuit 145 which filters and amplifies the output. For the purposes of this example, the present invention contemplates that the ECG electrode sensors 112 and activity sensor 114 are analog signals that are communicated to an analog-to-digital (A/D) converter and communicated to the microprocessor 40 as digital signals along signal path 141. Digital sensors may be substituted, bypassing the A/D converter 147.

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Communication between the microprocessor 142 and memory/storage 144 is provided by memory line 143. The data storage (memory) device 144 is optionally included for storing the ECG signal data, pre-set threshold limits for the physiological conditions being monitored, and user input received through the user interface module 170.

In the interest of keeping the monitor 100 compact and lightweight, the memory 144 may be limited to internal CPU/microprocessor memory, which for example, may be static random access memory or "flash" memory, their equivalents, or any of the above in combination with conventional magnetic storage such as a small portable disk drive unit. If the memory comprises only an internal CPU flash memory with limited data storage capacity, the ECG signal data detected by electrodes 112 may be stored into memory in a continuous overwrite mode.

In the present embodiment, flash memory (e.g., 128K of SRAM) is provided. Under normal circumstances when no arrhythmia event is occurring, the monitoring system 10 continuously overwrites the ECG data in the CPU flash memory. When an arrhythmia event does occur, the monitoring system 10 retains the data for the short time period surrounding the event (e.g. 1 minute) in the memory for later study. As will be appreciated by one of skill, the information may be stored in reserved areas of a looping memory, preferably in identifiable memory partitions and accessed in sections or in its entirety with the appropriate external device to initiate and receive such transmissions from the monitoring system 10. Event recording using such a looping memory is detailed in the prior art such as in U.S. Patent No. 5,987,352 to Klein, Warkentin, Riff, Lee, Carney, Turi, and Varrichio, and assigned to Medtronic, Inc., which patent is entitled "Minimally Invasive Implantable Device for Monitoring Physiologic Events," which is hereby incorporated by reference in its entirety.

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For each physiological parameter that is being monitored by the sensors 110, an individualized baseline or threshold may be computed and stored in the RAM memory of the microprocessor 142 or an optional external memory 144. In the case of some physiological parameters, fixed threshold levels may be used. The microprocessor 142 receives status information from the memory 144 regarding these system variables. In an exemplary embodiment, information regarding the arrhythmia frequency that is pre-determined to qualify as a class 1 arrhythmia event is stored in the flash memory of the microprocessor 142. If the ECG sensors measure electrical signals that exceed the programmed arrhythmia frequency, the microprocessor 142 alerts the patient through the user interface module 170, and/or with external devices through the wireless transmitter 109. In the case of alerts reflecting states in which the patient may require assistance, or may be unresponsive, alerts may instead or additionally be directed, by means of wireless transmission to an external system, such as to an emergency responder.

The user interface 170 communicates with the microprocessor 142 of the electronics module 140 via an internal digital input/output circuit which communicates directly with the microprocessor 142 on input/output lines. For instance, when the battery power is low (e.g., depletion within 24 hours of usage), the microprocessor prompts a message on the user display 106, warning the user that the battery power needs to be recharged. The user display 106 is a visual display that may be implemented as a light-emitting diode (LED) display, a dual-colored (back to back) LED, or a conventional alpha-numeric display such as a liquid crystal display (LCD). In the single LED embodiment, the microprocessor may cause the LED to flash to indicate low battery power or a system error. In a dual-colored LED embodiment, the microprocessor 142 may cause the LED to remain unlit and flash in two different colors to indicate the status of the battery power or

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other system functions. If an LCD is employed, the display may indicate the time of day as well as system status information.

In some embodiments, the pressing of the optional event button 104 by the ambulatory patient causes the user interface 170 to send a signal to the microprocessor 142 to trigger the acoustic alarm 162 which emits an audible alarm and optionally transmits an alarm signal to a wired or wireless transceiver or other external communication device (not shown) for contacting appropriate medical personnel. In addition, actuation of the event button 104 may cause the microprocessor 142 to record the time an event such as the suffering of chest pains or heart flutters occurred so that the ECG data recorded at that time can be flagged for closer examination. Pressing the event button 104 also causes the microprocessor 142 to store the ECG data sequence of the event in the flash memory of the microprocessor 142 for later transmission to an external monitoring device (not shown) and later study. In the event of a false alarm, the optional event button 104 may also be used to contact and to cancel the emergency help.

The acoustic alarm 162 also emits an acoustic signal when an observed cardiovascular activity or other physiological parameter surpasses a preset limit (e.g., surpassing the maximum number of arrhythmias preset by the doctor will generate an alarm). In the case of a physiological state that is inconsistent with normal physical activity on the part of the patient, if the activity monitor threshold is exceeded, such an alert may be suppressed as a false alarm.

The output of the sensors 110 (electrode sensors 112 and activity sensor 114) is coupled to a signal conditioning circuit 145, which amplifies and filters the signals, and converted to a digital format by the analog/digital converter. The signals from the activity sensor 114, once digitally processed, are input into an activity threshold detector 148,

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which is coupled to the A/D converter 147. The flow of signals and activity threshold detector 148 are set to a selected activity level by programmable activity level 149. The activity threshold detector 148 is connected to a control circuit in the microprocessor 142. The output of activity threshold detector 148 may be in binary form. For example, it may be a binary 1 if a threshold level of activity is sensed and a binary 0 if less than the threshold level of activity is sensed. The binary signal is fed to the control circuit of the microprocessor 142, which operates to power the alarm system 160. Multiple activity thresholds may be employed, establishing separate control levels for the separate adaptive functions of controlling non-urgent communication and urgent communication.

FIG 4 illustrates a flow chart of a method performed by the system 10 during adaptive monitoring of the patient according to an embodiment of the present invention. The microprocessor 142 initially sets up system variables in its memory so that the variables are proper for operation (step 200). For instance, data relating to the threshold conditions for each physiological parameter are entered into the memory of the microprocessor 142 serving the monitor 100. Thus, pre-determined baseline information regarding arrhythmia, such as the frequency and signal amplitude of electrocardiograms that would constitute a class 1 arrhythmic event are stored in the flash memory of the microprocessor 142. It is also within the scope of this invention to utilize algorithmic routines to calibrate non-static, non-preset thresholds that adapt to changing physical parameter base line information.

The system is also set so that various types of system errors, malfunctions or low power level (hereinafter collectively referred to as "errors") are categorized as either urgent or non-urgent and this information is contained in the memory. In an exemplary embodiment of the physiological monitoring system 10 of the present invention, the

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microprocessor 142 runs an error routine to check for errors. Based on pre-set information, it recognizes whether an error that has occurred is "urgent" (e.g., hardware or software malfunction, system crash, corrupted data, or other error that requires the user to reinitialize the system or to obtain technical servicing of the module) or "non-urgent" (e.g., signal loss from one of the several electrode sensors due to detachment from the patient's body, warning that 24 hours of battery operating time remains, or static or electrical interference issues) that will need eventual, but not immediate patient attention.

When the monitor 100 is powered up, the microprocessor 142 executes an initialization routine to prepare the monitor unit for operation (step 210). Part of the initialization routine is for the microprocessor 142 to perform power up tests of the monitor 100 and controls of the user interface 170, including the event button 104 and user display 106. If the system fails any of the power up tests, the microprocessor 142 idles and prompts status messages on the visual display through the user interface 170.

If the system checks were successfully completed, the system enables a data acquisition mode (step 220). During the data acquisition mode, the system 10 receives and processes information from the electrode sensors 112 and continuously overwrites the ECG data in the CPU flash memory 144. Although it is within the scope of this invention to do so, to conserve memory and processing power, the activity data from the activity sensors 114 is not recorded. The data acquisition mode also includes receiving and processing information about the activity level of the patient output from the activity sensor 114. As described above, the output from the activity sensor 114 is processed through an activity threshold detector.

The monitoring continues until signals from the electrode sensors exceed a pre-set threshold, and thus indicate a "cardiac event," (step 230). The microprocessor 142

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determines whether the signals indicate a cardiac event of the type that is life-threatening regardless of the physical activity level of the patient, or of another type that is life-threatening only if physical activity level is below a pre-set threshold. For cardiac events that are inconsistent with normal physical activity on the part of the patient (e.g., cardiac event is of the type that should not trigger an alarm condition if it is detected while the patient is physically active), the microprocessor 142 processes the output of the activity threshold detector 148.

If the microprocessor 142 determines that the measured signal level is above a pre-programmed activity threshold for a predetermined period of time (which may be medically and experimentally determined), indicating that the patient is in an alert state, the microprocessor 142 may suppress the cardiac event alert and return the system to the monitoring state 220. However, if in addition to exceeding the pre-set threshold for the electrode sensors, the activity level is below the set variable threshold (step 240), indicating that the patient is inactive, and has probably been rendered unconscious by the cardiac event, the microprocessor 142 does not suppress the cardiac event alert.

In certain embodiments of the invention, the PMS may be programmed with additional pre-set thresholds that recognize a variety of ECG signals and patterns that indicate a cardiac event even when physical activity is detected on the part of the patient. In such instances, when ECG signals of a pre-determined type exceed the pre-set threshold, the cardiac event alerting will remain unsuppressed regardless of the patient's activity level.

When an unsuppressed cardiac event occurs, the microprocessor 142 records the time from clock 146, turns off the ECG data overwriting routine and saves ECG data relating to the cardiac event and a buffer time period before and after the event (e.g., 30

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seconds before and 30 seconds after the event) in the flash memory of the microprocessor 142 for later transmission to an external monitoring device (not shown) and later study (step 250). It also signals the alarm circuit 160 to trigger the acoustic alarm 162 and sends a distress signal through the wireless transmitter 109 (step 260). The acoustic alarm continues to sound an alarm signal until it turned off by the patient or the doctor (step 270). If neither of the above events has occurred after a pre-set time interval of monitoring has occurred, the microprocessor 142 processes error routines (step 290).

At step 290, the microprocessor 142 checks for system errors and malfunctions and conducts a test for the battery power level. If any type of system error is detected during the error routine, the microprocessor 142 determines, based on the information in the memory 144, whether the error is urgent or non-urgent (step 300). If it is urgent, the microprocessor 142 sends a signal to trigger the acoustic alarm 162 and wireless transmitter 109 (step 310). However, if a non-urgent error is detected, the microprocessor 142 processes the output of the activity threshold detector 148.

If the microprocessor 142 determines that the measured signal level is above a pre-programmed activity threshold for a predetermined period of time (which may be medically and experimentally determined), indicating that the patient is in an alert state, the microprocessor 142 may sound an acoustic alarm 162 and wireless transmitter 109 to alert the patient to system malfunctions or errors requiring immediate attention. However, if the activity level drops below the set variable threshold (step 320), indicating that the patient is asleep or resting, the microprocessor 142 triggers a silent alarm such as a visual message on the user display 106 (step 330). The system 10 is designed to continue to monitor the patient normally until the activity level rises above the activity threshold, in which case, the system triggers the acoustic alarm (step 260).

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Although various embodiments are specifically illustrated and described herein, it will be appreciated that modifications and variations of the invention are covered by the above teachings and are within the purview of the appended claims without departing from the spirit and intended scope of the invention. For example, specific electrodes for the monitoring system are depicted herein, yet other sensors are possible without departing from the scope of the present invention. Substitute sensors that detect physiological characteristics that function similarly to electrodes will be obvious to one of ordinary skill in the art. Moreover, while three electrodes are shown, other numbers of electrodes can be used without departing from the scope of the present invention. Furthermore, these examples should not be interpreted to limit the modifications and variations of the invention covered by the claims but are merely illustrative of possible variations.

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CLAIMS

1. A physiological monitoring system (10) which comprises:

at least one sensor for detecting a biological signal (112), representative of a physiological characteristic of a monitor-wearing patient and generating an electrical signal representative of the biological signal;

at least one sensor for detecting the physical activity of the patient (114) and generating an electrical signal, representative of physical activity;

processing means (142), coupled to said sensors (112, 114) for processing said electrical signals;

an activity threshold detector (148) coupled to said processing means (142) for receiving said electrical signals representative of physical activity;

means for testing system functions;

a user interface (170) for communicating information about the detected biological signal and system functions to the patient;

means for controlling the communication of information (109) in response to detection of an activity threshold by said activity threshold detector (148).

2. The system of claim 1, further comprising a means for programming said physical activity sensor 114 for operational control at a selected threshold of physical activity.

3. The system of claim 1, wherein the physiological characteristic sensor (112) is adapted to sense cardiac signals.

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4. The system of claim 1, wherein the physiological characteristic sensor (112) comprises electrocardiography electrodes that detect biological signals representative of the heart beats of the patient.

5. The system of claim 1, wherein the physical activity sensor (114) comprises a transducer that detects chemical, electrical or mechanical characteristics of a monitor-wearing patient, representative of physical activity, including vibrations, motion, acceleration, electromyographic impulses, or sound impulses.

6. The system of claim 1, wherein the physical activity sensor (114) comprises an accelerometer, a pedometer, an electrical noise detector, electronic capacitive sensor, an electromyographic sensor, a skin impedance sensor, or a piezoelectric sensor.

7. The system of claim 1, wherein the physical activity sensor (114) is a passive transducer including a piezeoelectric element.

8. The system of claim 1, further comprising a means for wireless transmission of information (109) about the detected biological signal or system functions to a receiver external to the system.

9. An ambulatory electrocardiography monitoring system (10) for recording electrocardiography signals from a patient, comprising:

a plurality of sensors (110) for detecting a plurality of biological signals, each biological signal representative of a physiological characteristic of a monitor-wearing patient, wherein at least one sensor (110) comprises a one or more electrocardiography

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electrodes (112) that sense electrocardiography signals from a patient and at least one sensor (110) comprises a sensor that detects the activity level of the patient (114), whereby the sensors generate an electrical signal representative of each respective biological signal;

an arrhythmia threshold detector (142) coupled to the electrocardiography sensor (112) for receiving said electrical signals representative of the electrocardiography signals and determining whether the signals are below or above a preset threshold;

an activity threshold detector(148) coupled to the activity sensor (114) for receiving said electrical signals representative of the activity level of the patient and determining whether the signals are below or above a predetermined threshold;

system error detector (142) for detecting system errors, including signal loss, electrode detachment from patient, low battery power, corrupted data, or electrical interference and determining if the detected error meets pre-determined criteria;

processor (142) for controlling the communication of system and biological signal information to the patient through a user interface (170) based on the detection of an activity threshold by said activity threshold detector (148), arrhythmia threshold by said arrhythmia threshold detector (142), and/or system errors by the system error detector (142).

10. The system of claim 9, wherein the user interface (170) comprises an alarm circuit (160) comprising acoustic, tactile, or visual modes of communicating information to the patient, and mode is determined by processor (142) based on whether the signals from the respective detectors (142, 148) meet pre-determined thresholds.

11. The system of claim 9, wherein processor (142) further comprises a calibration means for setting the threshold of the arrhythmia threshold detector (142) based on

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processing of electrocardiography signals from the patient to generate a baseline of electrocardiography information.

12. The system of claim 9, wherein the threshold of the arrhythmia threshold detector (142) is pre-programmed into a memory component (142, 144) of the system (10).

13. The system of claim 9, wherein the physical activity sensor (114) comprises a transducer that detects chemical, electrical or mechanical characteristics of a monitor-wearing patient, representative of physical activity, including vibrations, motion, acceleration, electromyographic impulses, or sound impulses.

14. The system of claim 9, wherein the physical activity sensor (114) comprises an accelerometer, a pedometer, an electrical noise detector, electronic capacitive sensor, an electromyographic sensor, a skin impedance sensor, or a piezoelectric sensor.

15. The system of claim 9, wherein the physical activity sensor (114) is a passive transducer including a piezeoelectric element.

16. The system of claim 9, wherein the arrhythmia threshold detector (142) is set at a pre-determined threshold to detect the occurrence of class 1 arrhythmia event.

17. The system of claim 9, further comprising means of wireless communication (109) to an external system, for communication of information about the patient and system state to the patient or to others.

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18. A method for communicating information about a patient during ambulatory monitoring of a physiological condition of the patient comprising the steps of:

attaching a physiological monitoring system (10) to a patient;

sensing one or more selected physiological parameters of the patient;

sensing the physical activity of the patient;

comparing the sensed physical activity to a pre-set threshold to determine whether the physical activity exceeds the threshold;

detecting a system error to be communicated to the patient and determining whether the detected error meets pre-determined criteria;

generating an error signal based on the system error and transmitting the error signal to the patient via a user interface (170), if the physical activity of the patient exceeds the pre-set threshold.

19. The method of claim 18, wherein the physical activity sensor (114) comprises a transducer that detects pre-determined chemical, electrical or mechanical characteristics of a monitor-wearing patient that are representative of physical activity, wherein the characteristics comprise vibrations, motion, acceleration, electromyographic impulses, or sound impulses.

20. The method of claim 18, wherein the physical activity sensor (114) comprises an accelerometer, a pedometer, a noise detector, electronic capacitive sensor, an electromyographic sensor, or a piezoelectric sensor.

21. The method of claim 18, wherein the selected physiological parameter of the patient is sensed by at least one sensor (110) comprising two or more electrocardiography

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electrodes (112) that sense electrocardiography signals from the patient, whereby the sensor (110) generates an electrical signal representative of the selected physiological parameter.

22. The method of claim 18, wherein the physiological parameter comprises electrocardiography signals and the threshold of the selected physiological parameter of the patient is detected by an arrhythmia threshold detector (142) that determines whether the sensed electrocardiography signals are below or above a selected threshold representing an arrhythmic event.

23. A method for communicating information about a patient during ambulatory monitoring of a physiological condition of the patient comprising the steps of:

attaching a physiological monitoring system to a patient;

detecting a selected physiological parameter of the patient

sensing the physical activity of the patient;

detecting a selected threshold of the physical activity of the patient;

comparing the detected physiological parameter with pre-determined criteria to determine a physiological state of the patient reflecting an alarm condition;

generating an alert signal if the physiological condition of the patient reflects an alarm condition; and

transmitting the signal to the patient via a user interface (170), if the physical activity of the patient is below the selected threshold.

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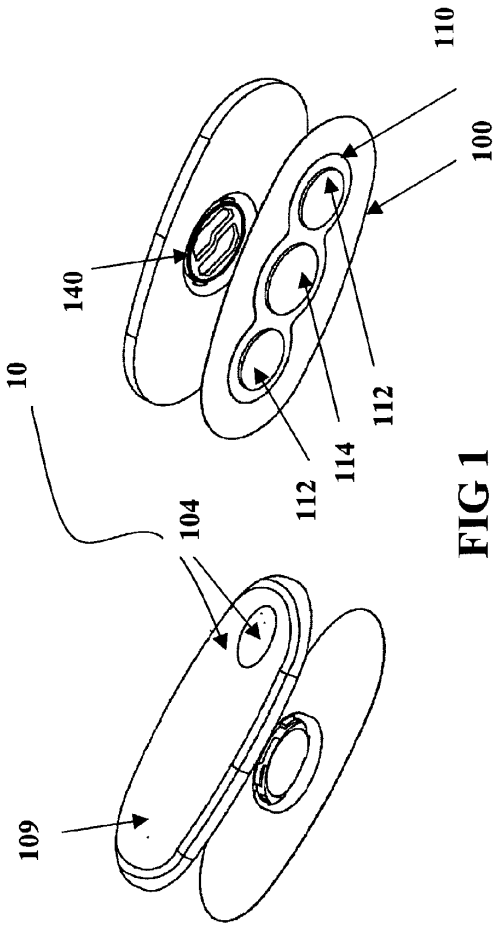


FIG 1

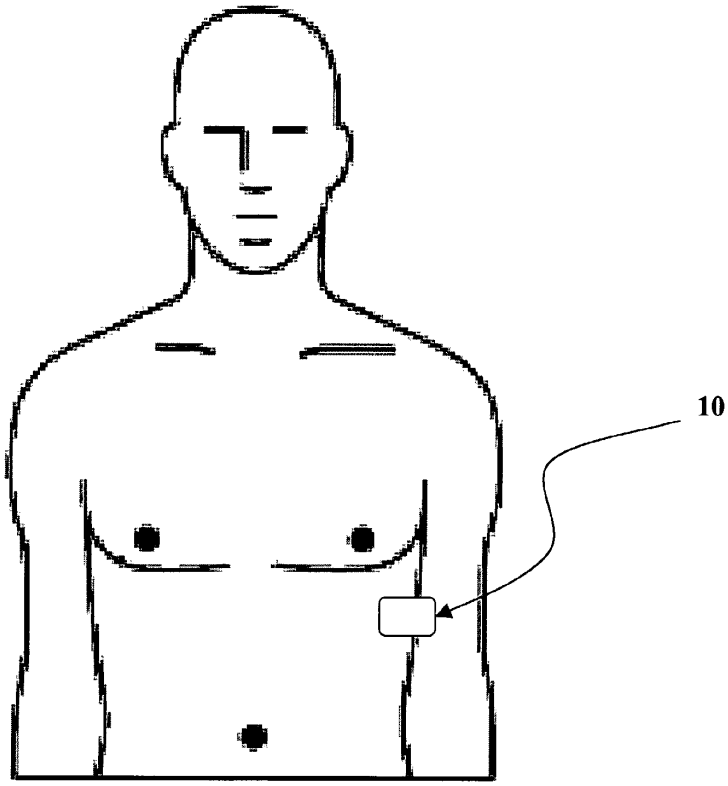


FIG 2

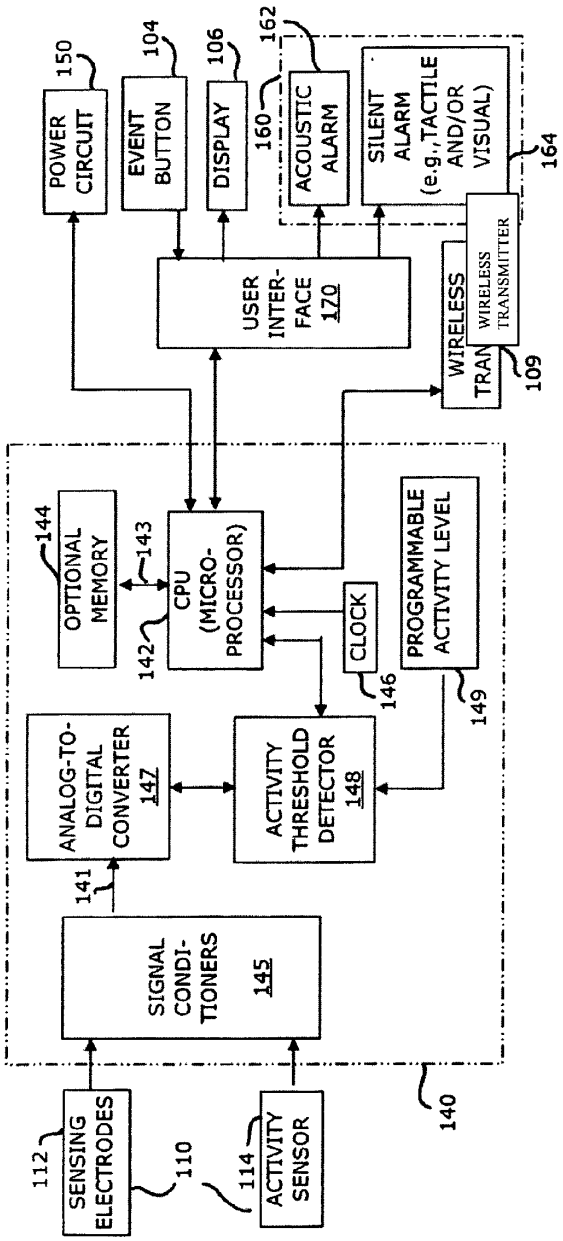

POWER CIRCUIT
150
EVENT BUTTON
104
DISPLAY
106
ACOUSTIC ALARM
160
162
SILENT ALARM (e.g.,TACTILE AND/OR VISUAL)
164
USER INTER-FACE 170
WIRELESS TRANSMITTER
109
OPTIONAL MEMORY
144
143
CPU (MICRO-PROCESSOR)
142
CLOCK
146
PROGRAMMABLE ACTIVITY LEVEL
149
ANALOG-TO-DIGITAL CONVERTER 147
ACTIVITY THRESHOLD DETECTOR 148
141
SIGNAL CONDI-TIONERS 145
140
SENSING ELECTRODES
112
110
ACTIVITY SENSOR
114

FIG 3

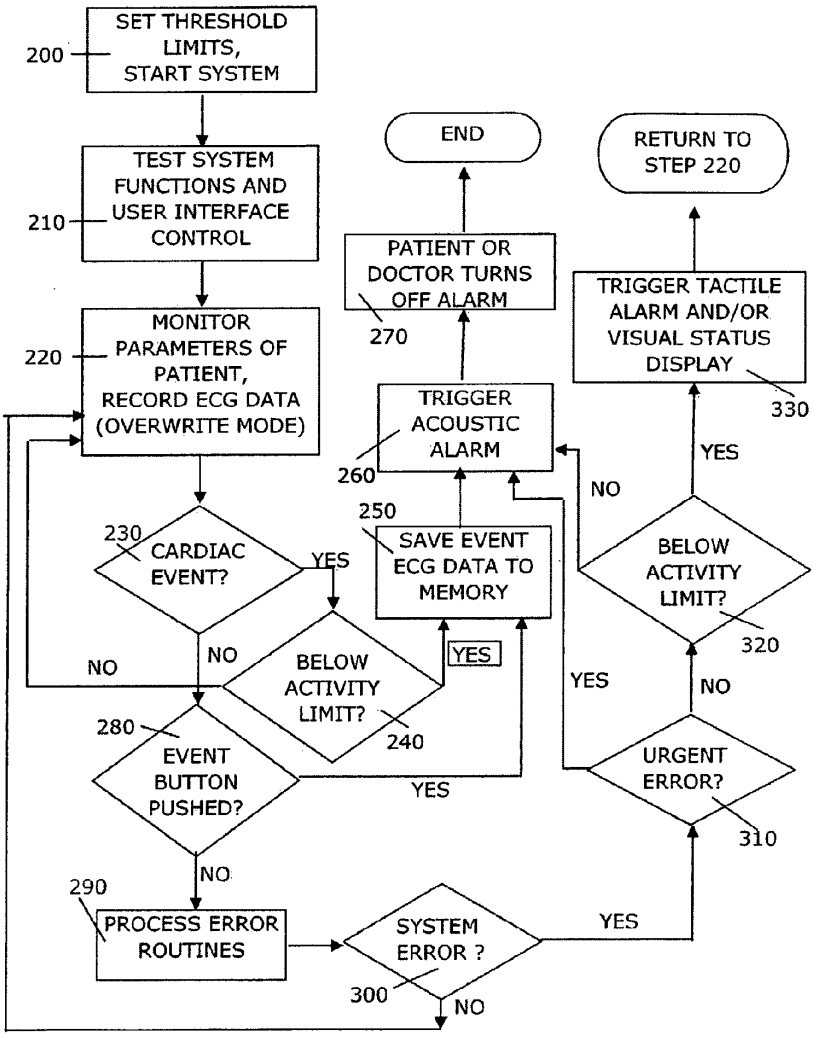

SET THRESHOLD LIMITS, START SYSTEM
200
TEST SYSTEM FUNCTIONS AND USER INTERFACE CONTROL
210
MONITOR PARAMETERS OF PATIENT, RECORD ECG DATA (OVERWRITE MODE)
220
CARDIAC EVENT?
230
YES
NO
BELOW ACTIVITY LIMIT?
240
YES
NO
EVENT BUTTON PUSHED?
280
YES
NO
PROCESS ERROR ROUTINES
290
SYSTEM ERROR ?
300
YES
NO
SAVE EVENT ECG DATA TO MEMORY
250
TRIGGER ACOUSTIC ALARM
260
PATIENT OR DOCTOR TURNS OFF ALARM
270
END
BELOW ACTIVITY LIMIT?
320
YES
NO
URGENT ERROR?
310
YES
NO
TRIGGER TACTILE ALARM AND/OR VISUAL STATUS DISPLAY
330
RETURN TO STEP 220

FIG 4

INTERNATIONAL SEARCH REPORT

International Application No
PCT/IB2005/050056

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61B5/00

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 7 A61B

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, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 404 877 A (NOLAN ET AL) 11 April 1995 (1995-04-11) column 1, line 7 - column 9, line 22	1-17
X	US 6 662 032 B1 (GAVISH BENJAMIN ET AL) 9 December 2003 (2003-12-09) paragraphs '0002!, '0175!, '0253!, '0312! - '0326!, '0335!, '0388! - '0390!	1-8
A	US 6 280 409 B1 (STONE KAREN A ET AL) 28 August 2001 (2001-08-28) the whole document	1-17
A	US 6 527 729 B1 (TURCOTT ROBERT) 4 March 2003 (2003-03-04) the whole document	1-17

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

[X] Patent family members are listed in 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
23 March 2005	31/03/2005

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, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Aronsson, F

Form PCT/ISA/210 (second sheet) (January 2004)

INTERNATIONAL SEARCH REPORT

International Application No
PCT/IB2005/050056

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6 160 478 A (JACOBSEN ET AL) 12 December 2000 (2000-12-12) the whole document -----	1-17
A	US 5 987 352 A (KLEIN ET AL) 16 November 1999 (1999-11-16) cited in the application the whole document -----	1-17

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FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box II.1

Claims Nos.: 18-23

Rule 39.1(iv) PCT - Diagnostic method practised on the human or animal body
The subject-matter of claims 18-21 does not explicitly refers to diagnostic methods, but can still be interpreted as such for the following reasons:
Since the dependent claim 23 explicitly refers to a diagnostic method, it is considered to be embraced by the scope of its independent claim (18) and thus implicitly comprised in the subject-matter of claim 18.
Further, the steps of:
sensing the physical activity of the patient and
comparing the sensed physical activity to a pre-set threshold to determine whether the physical activity exceeds the threshold,
can also be interpreted as a diagnostic method, because physical activity could refer to for example heart activity.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2005/050056

Box 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. [X] Claims Nos.: 18-23
because they relate to subject matter not required to be searched by this Authority, namely:

see FURTHER INFORMATION sheet PCT/ISA/210

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 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:

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 fee, this Authority did not invite payment of any additional fee.

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.

[ ] No protest accompanied the payment of additional search fees.

AliveCor Exhibit 1002
AliveCor, Inc. v. Apple Inc.
IPR2023-01434, U.S. Patent No. 10,270,898
1951 of 2716

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/IB2005/050056

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5404877 A	11-04-1995	EP 0627194 A2	07-12-1994
US 6662032 B1	09-12-2003	AU 5842000 A	22-01-2001
		CA 2343537 A1	11-01-2001
		EP 1178751 A2	13-02-2002
		WO 0102049 A2	11-01-2001
		US 2004077934 A1	22-04-2004
US 6280409 B1	28-08-2001	US 6045513 A	04-04-2000
		CA 2331500 A1	18-11-1999
		EP 1079733 A1	07-03-2001
		JP 2002514454 T	21-05-2002
		WO 9958056 A1	18-11-1999
		US 6102874 A	15-08-2000
US 6527729 B1	04-03-2003	US 6477406 B1	05-11-2002
		US 6480733 B1	12-11-2002
		US 6409675 B1	25-06-2002
		US 6491639 B1	10-12-2002
		US 6600949 B1	29-07-2003
US 6160478 A	12-12-2000	FR 2785073 A1	28-04-2000
		US 2001004234 A1	21-06-2001
US 5987352 A	16-11-1999	US 6412490 B1	02-07-2002
		US 6496715 B1	17-12-2002
		AU 721854 B2	13-07-2000
		AU 3668097 A	09-02-1998
		CA 2260209 A1	22-01-1998
		CA 2466742 A1	22-01-1998
		EP 0944414 A2	29-09-1999
		JP 2000514682 T	07-11-2000
		WO 9802209 A2	22-01-1998

Form PCT/ISA/210 (patent family annex) (January 2004)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	**FOR FURTHER ACTION**	see Form PCT/ISA/220 as well as, where applicable, item 5 below.
720642001640		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/US2013/073195	4 December 2013 (04-12-2013)	
Applicant		
PEARL CAPITAL DEVELOPMENTS LLC		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 3 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**
   a. With regard to the **language,** the international search was carried out on the basis of:
      [X] the international application in the language in which it was filed
      [ ] a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))
   b. [ ] This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6*bis*(a)).
   c. [ ] With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. [ ] **Certain claims were found unsearchable** (See Box No. II)

3. [ ] **Unity of invention is lacking** (see Box No III)

4. With regard to the **title,**
   [ ] the text is approved as submitted by the applicant
   [X] the text has been established by this Authority to read as follows:

   PRESENTATION OF PHYSIOLOGICAL DATA

5. With regard to the **abstract,**
   [X] the text is approved as submitted by the applicant
   [ ] the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority

6. With regard to the **drawings,**
   a. the figure of the **drawings** to be published with the abstract is Figure No. 1B
      [X] as suggested by the applicant
      [ ] as selected by this Authority, because the applicant failed to suggest a figure
      [ ] as selected by this Authority, because this figure better characterizes the invention
   b. [ ] none of the figures is to be published with the abstract

AliveCor Exhibit 1002
AliveCor, Inc. v. Apple Inc.
IPR2023-01434, U.S. Patent No. 10,270,898
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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2013/073195

A. CLASSIFICATION OF SUBJECT MATTER
INV. G06Q50/22 G06Q50/24
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)
G06Q

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)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2013/262155 A1 (HINKAMP THOMAS J [US]) 3 October 2013 (2013-10-03) abstract; figures 3,4	1-28
X	WO 99/41682 A2 (SOUTHERN RES INST [US]; DEAN ALAN HOYT [US]; JOHNSON DAVID WAYNE [US];) 19 August 1999 (1999-08-19) figures 1,6-15	1-28
X	US 2011/137678 A1 (WILLIAMS MICHAEL C [US]) 9 June 2011 (2011-06-09) paragraph [0007]; claim 1; figure 1	1-28

☐ 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	Date of mailing of the international search report
16 June 2014	23/06/2014

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	Laub, Christoph

3

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2013/073195

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2013262155 A1	03-10-2013	NONE	
WO 9941682 A2	19-08-1999	AU 2762899 A	30-08-1999
		WO 9941682 A2	19-08-1999
US 2011137678 A1	09-06-2011	NONE	

Form PCT/ISA/210 (patent family annex) (April 2005)

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

PCT

To:
Ho, Brian B.
MORRISON & FOERSTER LLP
425 Market Street
San Francisco, CA 94105-2482
ETATS-UNIS D'AMERIQUE

INVITATION TO PAY ADDITIONAL FEES
AND, WHERE APPLICABLE, PROTEST FEE
(PCT Article 17(3)(a) and Rule 40.1 and 40.2(e))

	Date of mailing *(day/month/year)* 22 December 2015 (22-12-2015)
Applicant's or agent's file reference 106842127040	**PAYMENT DUE** within **ONE MONTH** from the above date of mailing
International application No. PCT/US2015/047282	International filing date *(day/month/year)* 27 August 2015 (27-08-2015)
Applicant APPLE INC.	

1. This International Searching Authority

(i) considers that there are 6 *(number of)* inventions claimed in the international application covered by the claims indicated on an extra sheet:

(ii) therefore considers that **the international application does not comply with the requirements of unity of invention** (Rules 13.1, 13.2 and 13.3) for the reasons indicated on an extra sheet:

(iii) [X] has carried out a partial international search (see Annex) [ ] will establish the international search report on those parts of the international application which relate to the invention first mentioned in claims Nos.:

see extra sheet

(iv) will establish the international search report on the other parts of the international application only if, and to the extent to which, additional fees are paid.

2. Consequently, the applicant is hereby **invited to pay**, within the time limit indicated above, the amount indicated below:

EUR 1.875,00	x	5	=	EUR 9.375,00
Fee per additional invention		number of additional inventions		currency/total amount of additional fees

3. The applicant is informed that, according to Rule 40.2(c), **the payment of any additional fee may be made under protest**, i.e., a reasoned statement to the effect that the international application complies with the requirement of unity of invention or that the amount of the required additional fee is excessive, where applicable, subject to the payment of a protest fee.

Where the applicant pays additional fees under protest, the applicant is hereby invited, within the time limit indicated above, to pay a protest fee (Rule 40.2(e)) in the amount of EUR 865,00 *(currency/amount)*

Where the applicant has not, within the time limit indicated above, paid the required protest fee, the protest will be considered not to have been made and the International Searching Authority will so declare.

4. [ ] Claim(s) Nos. _____ have been found to be unsearchable under Article 17(2)(b) because of defects under Article 17(2)(a) and therefore have not been included with any invention.

Name and mailing address of the International Searching Authority	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk Tel. (+31-70) 340-2040 Fax: (+31-70) 340-3016	SOLIMAN, Ahmed Tel: +31 (0)70 340-4135

Form PCT/ISA/206 (April 2005)
Registered Mail

INVITATION TO PAY ADDITIONAL FEES

International application No.
PCT/US2015/047282

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-46, 223-243, 375-377, 388

Apparatus and method to track two types of user physical activities of a user based on sensor data, and display performance vs. goals.

2. claims: 47-71, 244-265, 378, 379, 389, 394

Apparatus and method to track user physical activity further considering inactivity periods by means of a timer.

3. claims: 72-115, 266-306, 380, 381, 390, 395

Apparatus and method to track two types of user physical activities further considering inactivity periods.

4. claims: 116-135, 307-323, 382, 383, 391, 396

Apparatus and method to track three types of user physical activity and display of the three activities.

5. claims: 136-198, 324-353, 384, 385, 392, 397

Apparatus and method to assist a user in setting fitness goals.

6. claims: 199-222, 354-374, 386, 387, 393, 398

Apparatus and method to review historical data of user physical activities.

This Authority considers that the application does not meet the requirements of unity of invention and that there are six invention covered by the claims indicated as follows. These inventions correspond to the six sets of claims also noted by the Applicant in his response to the invitation to provide formal clarification.

Invention 1: claims 1-46, 223-243, 375-377, 388
Apparatus and method to track two types of user physical activities of a user based on sensor data, and display performance vs. goals.
Invention 2: claims: 47-71, 244-265, 378, 379, 389, 394
Apparatus and method to track user physical activity and inactivity based on sensor data.
Invention 3: claims: 72-115, 266-306, 380, 381, 390, 395
Apparatus and method to track two types of user physical activities

AliveCor Exhibit 1002
AliveCor, Inc. v. Apple Inc.
IPR2023-01434, U.S. Patent No. 10,270,898
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further considering inactivity periods, based on sensor data.
Invention 4: claims: 116-135, 307-323, 382, 383, 391, 396
Apparatus and method to track three types of user physical activity and display of the three activities, based on sensor data.
Invention 5: claims: 136-198, 324-353, 384, 385, 392, 397
Apparatus and method to assist a user in setting fitness goals.
Invention 6: claims: 199-222, 354-374, 386, 387, 393, 398
Apparatus and method to review historical data of user physical activities.

The reasons for which the inventions are not linked as to form a single general inventive concept, as required by Rule 13.1 PCT, are as follows:
The only possible common feature of claims 1-398 is a method and an apparatus to display user physical activity, by means of a user interface. Inventions 1 to 4 further comprise sensors.These common features are well-known in the prior art and therefore can not form the required link between the above-mentioned inventions. An example of prior art comprising such features is US 2014/239065 A1 (ZHOU TIGER T G [US] ET AL) 28 August 2014 (2014-08-28).
Since inventions 1 to 6 have no common special technical features, nor do they solve a common problem, these inventions do not form a single inventive concept and do not have unity of invention as required by Rule 13.2 PCT.

The attention is especially drawn hereby to the following: under Article 17.3(a) PCT, it is not possible to choose the invention to be searched in case of non-unity. Therefore, the invention first mentioned in the claims has been searched.

AliveCor Exhibit 1002
AliveCor, Inc. v. Apple Inc.
IPR2023-01434, U.S. Patent No. 10,270,898
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Annex to Form PCT/ISA/206
COMMUNICATION RELATING TO THE RESULTS OF THE PARTIAL INTERNATIONAL SEARCH

International Application No
PCT/US2015/047282

1. The present communication is an Annex to the invitation to pay additional fees (Form PCT/ISA/206). It shows the results of the international search established on the parts of the international application which relate to the invention first mentioned in claims Nos.:
see 'Invitation to pay additional fees'
2. This communication is not the international search report which will be established according to Article 18 and Rule 43.

3. If the applicant does not pay any additional search fees, the information appearing in this communication will be considered as the result of the international search and will be included as such in the international search report.

4. If the applicant pays additional fees, the international search report will contain both the information appearing in this communication and the results of the international search on other parts of the international application for which such fees will have been paid.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2014/239065 A1 (ZHOU TIGER T G [US] ET AL) 28 August 2014 (2014-08-28) paragraph [0005] - paragraph [0024] paragraph [0042] - paragraph [0050] paragraph [0086] - paragraph [0090] figures 1-7	1-46, 223-243, 375-377, 388
X	US 2014/139637 A1 (MISTRY PRANAV [US] ET AL) 22 May 2014 (2014-05-22) paragraph [0005] - paragraph [0097] paragraph [0217] figures 1-157	1-46, 223-243, 375-377, 388
A	US 2014/244009 A1 (MESTAS ALEX [US]) 28 August 2014 (2014-08-28) paragraph [0005] - paragraph [0137] paragraph [0325] figures 1-181	1-46, 223-243, 375-377, 388
A	US 2013/203475 A1 (KIL DAVID H [US] ET AL) 8 August 2013 (2013-08-08) paragraph [0004] - paragraph [0024] figures 1-12	1-46, 223-243, 375-377, 388

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

☒ Patent family members are listed in 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

Form PCT/ISA/206 (Annex, first sheet) (July 1992, reprint January 2004)

Patent Family Annex

Information on patent family members

International Application No
PCT/US2015/047282

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2014239065 A1	28-08-2014	NONE	
US 2014139637 A1	22-05-2014	AU 2013260683 A1	05-06-2014
		CN 104919390 A	16-09-2015
		EP 2733579 A2	21-05-2014
		US 2014139637 A1	22-05-2014
		US 2015181087 A1	25-06-2015
		WO 2014081181 A1	30-05-2014
US 2014244009 A1	28-08-2014	BR 102014004317 A2	07-07-2015
		CN 104122994 A	29-10-2014
		EP 2770454 A1	27-08-2014
		JP 2014168685 A	18-09-2014
		KR 20140105407 A	01-09-2014
		US 2014244009 A1	28-08-2014
		WO 2014130805 A1	28-08-2014
US 2013203475 A1	08-08-2013	US 2013203475 A1	08-08-2013
		WO 2013113036 A1	01-08-2013

AliveCor Exhibit 1002
AliveCor, Inc. v. Apple Inc.
IPR2023-01434, U.S. Patent No. 10,270,898
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Information on Search Strategy - Pilot phase (see OJ 2015, A66)
The type of information contained in this sheet may change during the pilot for improving the usefulness of this new service.

Application Number
PCT/US2015/047282

TITLE: PHYSICAL ACTIVITY AND WORKOUT MONITOR

APPLICANT: APPLE INC.

IPC CLASSIFICATION: G06F19/00

EXAMINER: Hernández Marugán, J

CONSULTED DATABASES: DOSYS, EPODOC, WPI, TXTE, INET

CLASSIFICATION SYMBOLS DEFINING EXTENT OF THE SEARCH:

IPC:

CPC: G06F19/3481

FI/F-TERMS:

KEYWORDS OR OTHER ELEMENTS FEATURING THE INVENTION:

EPO FORM P0444

European Patent Organisation

Account details

N° 3 338 800 00 (BLZ 700 800 00)
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Promenadeplatz 7
D-80273 München
SWIFT Code: DRESDEFF700
IBAN: DE20 7008 0000 0333 8800 00
BIC: DRESDEFF

BNSDOCID: <XS_____20070401OCR_1_>

Electronic Acknowledgement Receipt

EFS ID:	25401521
Application Number:	14599424
International Application Number:	
Confirmation Number:	3136
Title of Invention:	WELLNESS AGGREGATOR
First Named Inventor/Applicant Name:	Christopher D. Soli
Customer Number:	119082
Filer:	Jordan Michael Lofdahl/Sonja Talley
Filer Authorized By:	Jordan Michael Lofdahl
Attorney Docket Number:	106842130031 (P23397US3)
Receipt Date:	05-APR-2016
Filing Date:	16-JAN-2015
Time Stamp:	14:16:18
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	106842130031_IDS.pdf	149729 48b7d3f748ee326e6930c36d285224048be62267	no	4
Warnings:					
Information:					

This is not an USPTO supplied IDS fillable form					
2	Foreign Reference	WO_9941682_A2.pdf	823176 c8474f0ff8ce26382cb96c6f31067bef7abc5b7f	no	24
Warnings:					
Information:					
3	Foreign Reference	WO_2005070289_A1.pdf	1216888 8928b74cd6ee3f2c1925ce679b03c0a3282d347d	no	35
Warnings:					
Information:					
4	Non Patent Literature	14839916_NFOA_02_04_2016.pdf	730922 583028c034212381a95d9eaa7d31e959cce94a16	no	19
Warnings:					
Information:					
5	Non Patent Literature	14839922_NFOA_02_25_2016.pdf	701602 7ff70116e575d487800fe875bcc14fdc485f796e	no	20
Warnings:					
Information:					
6	Non Patent Literature	20152035850 55_CNNOA_01_13_2016.pdf	137757 eda6d002fe5584880f71d4aa9fc16141a4831f51	no	3
Warnings:					
Information:					
7	Non Patent Literature	PA201570666_DKOA_02_02_2016.pdf	164786 d44617f3573b734db416a057ce2a2980be2e4ef0	no	9
Warnings:					
Information:					
8	Non Patent Literature	PCTUS2013073195_ISR_06_23_2014.pdf	95671 a7d5cffc8be9e11fdd79284beb0a59db21b26898	no	3
Warnings:					
Information:					
9	Non Patent Literature	PCTUS2015047282_INVT_12_22_2015.pdf	508047 b1a50524c45e7143dfecb56716b57ac0b457ae64	no	7
Warnings:					
Information:					
		Total Files Size (in bytes):	4528578		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	14599424
	Filing Date	2015-01-16
	First Named Inventor	Christopher D. SOLI
	Art Unit	3626
	Examiner Name	R. W. Morgan
	Attorney Docket Number	106842130031 (P23397US3)

U.S.PATENTS

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	1.	8543081	B2	2013-09-24	Scott et al.	

U.S.PATENT APPLICATION PUBLICATIONS

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	1.	20130290013	A1	2013-10-31	Forrester, Andrew	
	2.	20130295872	A1	2013-11-07	Guday et al.	
	3.	20140199966	A1	2014-07-17	Schushan, Asaf	

FOREIGN PATENT DOCUMENTS

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2]	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear	T[5]

NON-PATENT LITERATURE DOCUMENTS

AliveCor Exhibit 1002
AliveCor, Inc. v. Apple Inc.
IPR2023-01434, U.S. Patent No. 10,270,898
1966 of 2716

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	14599424
	Filing Date	2015-01-16
	First Named Inventor	Christopher D. SOLI
	Art Unit	3626
	Examiner Name	R. W. Morgan
	Attorney Docket Number	106842130031 (P23397US3)

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1.	"i Phone User Guide For iOS 7.1 Software", available online at <https://manuals.info.apple.com/MANUALS/1000/MA1681/en_US/iphone_ios7_user_guide.pdf> retrieved on August 10, 2015, 162 pages.	
	2.	Office Action received for Australian Patent Application No. 2015100734, issued on July 29, 2015, 5 pages.	
	3.	International Search Report and Written Opinion received for PCT Application No. PCT/US2015/032474, mailed on August 19, 2015, 8 pages.	
	4.	Final Office Action received for U.S. Patent Application No. 14/599,425, mailed on October 08, 2015, 20 pages.	

EXAMINER SIGNATURE			
Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

AliveCor Exhibit 1002
AliveCor, Inc. v. Apple Inc.
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	14599424
	Filing Date	2015-01-16
	First Named Inventor	Christopher D. SOLI
	Art Unit	3626
	Examiner Name	R. W. Morgan
	Attorney Docket Number	106842130031 (P23397US3)

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document.
[4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

AliveCor Exhibit 1002
AliveCor, Inc. v. Apple Inc.
IPR2023-01434, U.S. Patent No. 10,270,898
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	14599424
	Filing Date	2015-01-16
	First Named Inventor	Christopher D. SOLI
	Art Unit	3626
	Examiner Name	R. W. Morgan
	Attorney Docket Number	106842130031 (P23397US3)

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e) (1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e) (2).

☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Jordan M. Lofdahl/	Date (YYYY-MM-DD)	2015-12-15
Name/Print	Jordan M. Lofdahl	Registration Number	59,163

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35

AliveCor Exhibit 1002
AliveCor, Inc. v. Apple Inc.
IPR2023-01434, U.S. Patent No. 10,270,898
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	14599424
	Filing Date	2015-01-16
	First Named Inventor	Christopher D. SOLI
	Art Unit	3626
	Examiner Name	R. W. Morgan
	Attorney Docket Number	106842130031 (P23397US3)

U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

AliveCor Exhibit 1002
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IPR2023-01434, U.S. Patent No. 10,270,898
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PATENT COOPERATION TREATY

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AUG 27 2015
Morrison | Foerster - SF

From the INTERNATIONAL SEARCHING AUTHORITY

PCT

To:
Ho, Brian B.
MORRISON & FOERSTER LLP
425 Market Street
San Francisco, CA 94105-2482
ETATS-UNIS D'AMERIQUE

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT AND THE WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY, OR THE DECLARATION

(PCT Rule 44.1)

Applicant's or agent's file reference 106842130040	Date of mailing *(day/month/year)* 19 August 2015 (19-08-2015) **FOR FURTHER ACTION** See paragraphs 1 and 4 below
International application No. PCT/US2015/032474	International filing date *(day/month/year)* 26 May 2015 (26-05-2015)
Applicant APPLE INC.	

1. [X] The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.

   Filing of amendments and statement under Article 19:
   The applicant is entitled, if he so wishes, to amend the claims of the international Application (see Rule 46):

   When? The time limit for filing such amendments is normally two months from the date of transmittal of the International Search Report.

   How? Directly to the International Bureau of WIPO, 34 chemin des Colombettes 1211 Geneva 20, Switzerland, Fascimile No.: (41-22) 338.82.70

   For more detailed instructions, see *PCT Applicant's Guide*, International Phase, paragraphs 9.004 - 9.011.

2. [ ] The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.

3. [ ] **With regard to any protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

   [ ] the protest together with the decision thereon has been transmitted to the International Bureau together with any applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.

   [ ] no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Reminders**

   The applicant may **submit comments on an informal basis on the written opinion of the International Searching Authority** to the International Bureau. These comments will be made available to the public after international publication. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established.

   Shortly after the expiration of **18 months from the priority date, the international application will be published** by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau before the completion of the technical preparations for international publication (Rules 90*bis*.1 and 90*bis*.3).

   Within **19 months** from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase **until 30 months** from the priority date (in some Offices even later); otherwise, the applicant must, **within 20 months** from the priority date, perform the prescribed acts for **entry into the national phase** before those designated Offices. In respect of other designated Offices, the time limit of **30 months** (or later) will apply even if no demand is filed within 19 months. For details about the applicable time limits, Office by Office, see www.wipo.int/pct/en/texts/time_limits.html and the *PCT Applicant's Guide*, National Chapters.

   Within **19 months from the priority date, the applicant may request that a supplementary international search be carried out** by a different International Searching Authority that offers this service (Rule 45*bis*.1). The procedure for requesting supplementary international search is described in the *PCT Applicant's Guide*, International Phase, paragraphs 8.005-8.032.

Name and mailing address of the International Searching Authority European Patent Office, P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk Tel. (+31-70) 340-2040 Fax: (+31-70) 340-3016	Authorized officer TEICHMANN, Ingrid Tel: +49 (0)89 2399-2381

Form PCT/ISA/220 (July 2014)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	FOR FURTHER ACTION	see Form PCT/ISA/220 as well as, where applicable, item 5 below
106842130040		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/US2015/032474	26 May 2015 (26-05-2015)	30 May 2014 (30-05-2014)
Applicant		
APPLE INC.		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 2 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**
   a. With regard to the **language,** the international search was carried out on the basis of:
      [X] the international application in the language in which it was filed
      [ ] a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))
   b. [ ] This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6*bis*(a)).
   c. [ ] With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. [ ] **Certain claims were found unsearchable** (See Box No. II)

3. [ ] **Unity of invention is lacking** (see Box No III)

4. With regard to the **title,**
   [ ] the text is approved as submitted by the applicant
   [X] the text has been established by this Authority to read as follows:

   WELLNESS DATA AGGREGATOR

5. With regard to the **abstract,**
   [X] the text is approved as submitted by the applicant
   [ ] the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority

6. With regard to the **drawings,**
   a. the figure of the **drawings** to be published with the abstract is Figure No. 24
      [ ] as suggested by the applicant
      [ ] as selected by this Authority, because the applicant failed to suggest a figure
      [X] as selected by this Authority, because this figure better characterizes the invention
   b. [ ] none of the figures is to be published with the abstract

AliveCor Exhibit 1002
AliveCor, Inc. v. Apple Inc.
IPR2023-01434, U.S. Patent No. 10,270,898
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International application No
PCT/US2015/032474

A. CLASSIFICATION OF SUBJECT MATTER
INV. G06Q10/06 G06F3/048 G06Q50/22 G06F19/00
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)
G06Q G06F

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)
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	"iPhone User Guide For iOS 7.1 Software", , 10 March 2014 (2014-03-10), pages 1-162, XP55207043, Retrieved from the Internet: URL:https://manuals.info.apple.com/en_US/iphone_ios7_user_guide.pdf [retrieved on 2015-08-10] Chapters 1, 3, 5, 6, 9	1-155

☐ 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	Date of mailing of the international search report
10 August 2015	19/08/2015

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	Stratford, Colin

Form PCT/ISA/210 (second sheet) (April 2005)

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

see form PCT/ISA/220

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY
(PCT Rule 43*bis*.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US2015/032474	26.05.2015	30.05.2014

International Patent Classification (IPC) or both national classification and IPC
INV. G06Q10/06 G06F3/048 G06Q50/22 G06F19/00

Applicant
APPLE INC.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☒ Box No. VII Certain defects in the international application
- ☒ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA:	Date of completion of this opinion	Authorized Officer
European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Fax: +49 89 2399 - 4465	see form PCT/ISA/210	Stratford, Colin Telephone No. +49 89 2399-0

Form PCT/ISA/237 (Cover Sheet) (January 2015)

Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of:

   ☒ the international application in the language in which it was filed.

   ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1 (b)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))

3. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:

   a. ☐ forming part of the international application as filed:

      ☐ in the form of an Annex C/ST.25 text file.

      ☐ on paper or in the form of an image file.

   b. ☐ furnished together with the international application under PCT Rule 13*ter*.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.

   c. ☐ furnished subsequent to the international filing date for the purposes of international search only:

      ☐ in the form of an Annex C/ST.25 text file (Rule 13*ter*.1(a)).

      ☐ on paper or in the form of an image file (Rule 13*ter*.1(b) and Administrative Instructions, Section 713).

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

AliveCor Exhibit 1002
AliveCor, Inc. v. Apple Inc.
IPR2023-01434, U.S. Patent No. 10,270,898
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Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	
	No:	Claims	
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-155
Industrial applicability (IA)	Yes:	Claims	1-155
	No:	Claims	

2. Citations and explanations

see separate sheet

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

AliveCor Exhibit 1002
AliveCor, Inc. v. Apple Inc.
IPR2023-01434, U.S. Patent No. 10,270,898
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1 **Item V**

1.1 Reference is made to the following document:

D1 "iPhone User Guide For iOS 7.1 Software", 10 March 2014 (2014-03-10), pages 1-162, XP55207043, Retrieved from the Internet: URL:https://manuals.info.apple.com/en_US/iphone_ios7_user_guide.pdf [retrieved on 2015-08-10]

1.2 The claimed subject-matter relates principally to various presentations of information (such as medical data, emergency contact information etc.) and administrative matters concerning a choice of data sources and recipients.

1.3 From a technical point of view, a generic smartphone is considered to constitute the relevant state of the art. Such a smartphone, as notoriously known prior to 2014, is deemed to have the following capabilities:

a. A processor

b. Memory (both volatile and non-volatile)

c. Touchscreen for displaying information and receiving user input

d. Means to detect a change in smartphone orientation

e. Means to make a phone call, send an email and an SMS message

1.4 Although not contributing to the technical character of the invention, for completeness it is noted that the following aspects would also have been anticipated by the notoriously known smartphone:

f. Touch gestures to select or scroll

g. A locked status in which a "lock screen" is displayed and functionality (including communications functionality) is limited. In this status certain inputs are recognised, such as the unlock gesture (which unlocks the device) and the emergency call function (which does not).

1.5 Such a smartphone was described, for example, in D1.

1.6 Claim 1 differs from the state of the art in that it displays two graphs, and alters the display (by providing an indication that something has been selected) in response to user input. This is a mere presentation of information devoid of any technical effect.

1.7 Claim 30 differs from the state of the art in that emergency information about the user of the device is displayed. This is clearly also devoid of any technical effect.

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1.8 Claim 47 differs from the state of the art in that the user can identify a plurality of approved sources and types of wellness data that can be stored in a database, and similarly can identify a plurality of approved destinations which may receive certain types of wellness data from the database. Given that the choice of sources and destinations for data is purely administrative (based on e.g. privacy considerations rather than technical reasons) also these aspects are devoid of any technical effect.

1.9 From the description, it is apparent that the Applicants did not seek to solve any technical problem, but rather wanted to allow users to store, view and share wellness data collected by different devices [0004]. The intuitiveness of one of the methods is also mentioned [0257]. However, these effects are unrelated to any specific technical implementation, and are in some cases subjective. The devices which collect the wellness data are actually absent from the claimed subject-matter, which is limited to receiving, processing, displaying and outputting cognitive (non-technical) data. This, however, is the standard task of the prior art smartphone.

1.10 The same objections apply to all of the claims, which provide further non-technical details. In conclusion, none of the claims demonstrate a technical contribution over the state of the art, and therefore their subject-matter is found not to involve an inventive step.

1.11 The industrial applicability of the claimed subject-matter is self-evident (Article 33(4) PCT).

2 **Item VII**

2.1 The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

2.2 Figures 1-5b do not meet the quality requirements set out in Rule 11.13(a) PCT.

3 **Item VIII**

3.1 The large number of independent claims leads to a lack of conciseness. Also in light of the requirements of unity of invention, it would appear appropriate to draft the claims in terms of a single method claim, a single device claim and a single computer-readable medium claim (see PCT Guidelines, 5.14).

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Electronic Acknowledgement Receipt

EFS ID:	24362181
Application Number:	14599424
International Application Number:	
Confirmation Number:	3136
Title of Invention:	WELLNESS AGGREGATOR
First Named Inventor/Applicant Name:	Christopher D. Soli
Customer Number:	119082
Filer:	Jordan Michael Lofdahl/Sonja Talley
Filer Authorized By:	Jordan Michael Lofdahl
Attorney Docket Number:	106842130031 (P23397US3)
Receipt Date:	15-DEC-2015
Filing Date:	16-JAN-2015
Time Stamp:	11:27:42
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	10684-2130031_IDS.pdf	150643 2be5838ae740b6bd8a2f2ba53f34f94b376d3000	no	5
Warnings:					
Information:					

This is not an USPTO supplied IDS fillable form					
2	Non Patent Literature	IphoneUserGuide_7_1.pdf	10038090 add2e095abb07e5edcee027e9df294121d9567b8	no	162
Warnings:					
Information:					
3	Non Patent Literature	2015100734_AUOA_07_29_2015.pdf	155515 1c1781a61699de68c433c6374f598295fe8a31da	no	5
Warnings:					
Information:					
4	Non Patent Literature	PCTUS2015032474_ISR_WO_08_19_2015.pdf	661606 13e0f83d8eb8bf810b7f4496168b44c08bbc0062	no	8
Warnings:					
Information:					
5	Non Patent Literature	14599425_FOA_10_08_2015.pdf	631511 2f79d4f02d5187be7ce0122570b6994bae60f624	no	20
Warnings:					
Information:					
		Total Files Size (in bytes):	11637365		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/599,424	01/16/2015	Christopher D. Soli	106842130031 (P23397US3)

CONFIRMATION NO. 3136

119082
Apple c/o MORRISON & FOERSTER LLP SF
425 MARKET STREET
SAN FRANCISCO, CA 94105-2485

PUBLICATION NOTICE

OC000000079063978

Title:WELLNESS AGGREGATOR

Publication No.US-2015-0347711-A1
Publication Date:12/03/2015

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently http://pair.uspto.gov/. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

AliveCor Exhibit 1002
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IPR2023-01434, U.S. Patent No. 10,270,898
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UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
14/599,424	01/16/2015	3626	2860	106842130031 (P23397US3)	29	3

CONFIRMATION NO. 3136

CORRECTED FILING RECEIPT

119082
Apple c/o MORRISON & FOERSTER LLP SF
425 MARKET STREET
SAN FRANCISCO, CA 94105-2485



Date Mailed: 10/27/2015

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Christopher D. Soli, Mountain View, CA;
Lawrence Y. Yang, San Francisco, CA;
Dennis S. Park, San Francisco, CA;
Stephen O. Lemay, Palo Alto, CA;
Daniel S. Keen, San Jose, CA;
James H. Foster, Palo Alto, CA;
Zachery Kennedy, San Jose, CA;
Michael O'reilly, San Jose, CA;
Guy L. Tribble, Hillsborough, CA;
Todd K. Whitehurst, Cupertino, CA;

Applicant(s)

Apple Inc., Cupertino, CA;

Power of Attorney: The patent practitioners associated with Customer Number 119082

Domestic Priority data as claimed by applicant

This appln claims benefit of 62/006,032 05/30/2014

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access - A proper **Authorization to Permit Access to Application by Participating Offices** (PTO/SB/39 or its equivalent) has been received by the USPTO.

AliveCor Exhibit 1002
AliveCor, Inc. v. Apple Inc.
IPR2023-01434, U.S. Patent No. 10,270,898
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If Required, Foreign Filing License Granted: 01/30/2015

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 14/599,424**

Projected Publication Date: 12/03/2015

Non-Publication Request: No

Early Publication Request: No

Title

WELLNESS AGGREGATOR

Preliminary Class

705

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

AliveCor Exhibit 1002
AliveCor, Inc. v. Apple Inc.
IPR2023-01434, U.S. Patent No. 10,270,898
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LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

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The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

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I hereby certify that this paper is being transmitted via the Office electronic filing system in accordance with 37 CFR § 1.6(a)(4).

Dated: October 20, 2015 Signature: /Allison Escobedo/
(Allison Escobedo)

Docket No.: 106842130031 (P23397US3)
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Christopher D. SOLI et al.

Application No.: 14/599,424 Confirmation No.: 3136

Filed: January 16, 2015 Art Unit: 3626

For: WELLNESS AGGREGATOR Examiner: R. W. Morgan

REQUEST TO CORRECT INVENTORSHIP UNDER 37 C.F.R. § 1.48

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Applicant respectfully requests that the inventorship of the above-captioned patent application be corrected to add the following inventors:

-- James H. FOSTER, Palo Alto, CA --
-- Zachery KENNEDY, San Jose, CA --
-- Michael O'REILLY, San Jose, CA --
-- Guy L. TRIBBLE, Hillsborough, CA --
-- Todd K. WHITEHURST, Cupertino, CA --

In support of this request, a corrected Application Data Sheet, and an executed Declaration from all named inventors is enclosed. The required fee(s) under 37 CFR 1.17(i) is authorized to be charged to **Deposit Account 03-1952**.

sf-3587467

The Patent and Trademark Office is respectfully requested to correct the inventorship in the above referenced patent application.

Applicant also hereby requests that a corrected Filing receipt be issued in the above-identified patent application.

In the event the Patent Office determines that an extension and/or relief is required, Applicant petitions for any required relief including extensions of time and authorize the Commissioner to charge the cost of such petitions and/or other fees due in connection with the filing of this document to Deposit Account No. 03-1952 referencing Docket No. **106842130031 (P23397US3)**.

Dated: October 20, 2015

Respectfully submitted,

By_____/Jordan Lofdahl/_____
Jordan Lofdahl
Registration No.: 59,163
MORRISON & FOERSTER LLP
370 Seventeenth Street, 5200 Republic Plaza
Denver, Colorado 80202-5638
(303) 592-2263

sf-3587467

Corrected Application Data Sheet

Inventor Information

Inventor Number::	1
Given Name::	Christopher
Middle Name::	D.
Family Name::	SOLI
City of Residence::	Mountain View
State or Province of Residence::	CA
Country of Residence::	US
Street of mailing address::	c/o Apple Inc.
	1 Infinite Loop
City of mailing address::	Cupertino
State or Province of mailing address::	CA
Postal or Zip Code of mailing address::	95014

Inventor Number::	2
Given Name::	Lawrence
Middle Name::	Y.
Family Name::	YANG
City of Residence::	San Francisco
State or Province of Residence::	CA
Country of Residence::	US

AliveCor Exhibit 1002
AliveCor, Inc. v. Apple Inc.
IPR2023-01434, U.S. Patent No. 10,270,898
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Street of mailing address::	~~c/o Apple Inc. 816 Haight Street~~ ~~1 Infinite Loop~~
City of mailing address::	~~Cupertino~~San Francisco
State or Province of mailing address::	CA
Postal or Zip Code of mailing address::	~~95014~~94117

Inventor Number::	3
Given Name::	Dennis
Middle Name::	S.
Family Name::	PARK
City of Residence::	San Francisco
State or Province of Residence::	CA
Country of Residence::	US
Street of mailing address::	c/o Apple Inc. 1 Infinite Loop
City of mailing address::	Cupertino
State or Province of mailing address::	CA
Postal or Zip Code of mailing address::	95014

Inventor Number::	4
Given Name::	Stephen
Middle Name::	O.
Family Name::	LEMAY

AliveCor Exhibit 1002
AliveCor, Inc. v. Apple Inc.
IPR2023-01434, U.S. Patent No. 10,270,898
1988 of 2716

City of Residence::	Palo Alto
State or Province of Residence::	CA
Country of Residence::	US
Street of mailing address::	c/o Apple Inc.
	1 Infinite Loop
City of mailing address::	Cupertino
State or Province of mailing address::	CA
Postal or Zip Code of mailing address::	95014

Inventor Number::	5
Given Name::	Daniel
Middle Name::	S.
Family Name::	KEEN
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State or Province of Residence::	CA
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Street of mailing address::	c/o Apple Inc.
	1 Infinite Loop
City of mailing address::	Cupertino
State or Province of mailing address::	CA
Postal or Zip Code of mailing address::	95014

Inventor Number::	6

Given Name::	James
Middle Name::	H.
Family Name::	FOSTER
City of Residence::	Palo Alto
State or Province of Residence::	CA
Country of Residence::	US
Street of mailing address::	c/o Apple Inc.
	1 Infinite Loop
City of mailing address::	Cupertino
State or Province of mailing address::	CA
Postal or Zip Code of mailing address::	95014

Inventor Number::	7
Given Name::	Zachery
Family Name::	KENNEDY
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State or Province of Residence::	CA
Country of Residence::	US
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City of mailing address::	San Jose
State or Province of mailing address::	CA
Postal or Zip Code of mailing address::	95112

Inventor Number::	8
Given Name::	Michael
Family Name::	O'REILLY
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State or Province of Residence::	CA
Country of Residence::	US
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	1 Infinite Loop
City of mailing address::	Cupertino
State or Province of mailing address::	CA
Postal or Zip Code of mailing address::	95014

Inventor Number::	9
Given Name::	Guy
Middle Name::	L.
Family Name::	TRIBBLE
City of Residence::	Hillsborough
State or Province of Residence::	CA
Country of Residence::	US
Street of mailing address::	c/o Apple Inc.
	1 Infinite Loop
City of mailing address::	Cupertino
State or Province of mailing address::	CA

Postal or Zip Code of mailing address::	95014
Inventor Number::	10
Given Name::	Todd
Middle Name::	K.
Family Name::	WHITEHURST
City of Residence::	Cupertino
State or Province of Residence::	CA
Country of Residence::	US
Street of mailing address::	c/o Apple Inc.
	1 Infinite Loop
City of mailing address::	Cupertino
State or Province of mailing address::	CA
Postal or Zip Code of mailing address::	95014

Correspondence Information

Correspondence Customer Number::	119082

Application Information

Application Number::	14/599,424
Filing Date::	01/16/15
Application Type::	Regular
Subject Matter::	Utility

AliveCor Exhibit 1002
AliveCor, Inc. v. Apple Inc.
IPR2023-01434, U.S. Patent No. 10,270,898
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CD-ROM or CD-R?::	None
Sequence submission?::	None
Computer Readable Form (CRF)?::	No
Title::	WELLNESS AGGREGATOR
Attorney Docket Number::	106842130031 (P23397US3)
Request for Early Publication?::	No
Request for Non-Publication?::	No
Small Entity?::	No
Petition included?::	No
Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2::	No
Authorization to Permit Access to the Instant Application by the Participating Offices::	No
This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013::	No

Signature:

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications.			
Signature	/Jordan Lofdahl/	Date 10/20/15	October 20, 2015
Name	Jordan Lofdahl	Registration Number	59,163

AliveCor Exhibit 1002
AliveCor, Inc. v. Apple Inc.
IPR2023-01434, U.S. Patent No. 10,270,898
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Application No. (if known): 14/599,424 Attorney Docket No.: 106842130031 (P23397US3)

Certificate of Electronic Filing Under 37 C.F.R. § 1.8

I hereby certify that this correspondence is being transmitted via the Office electronic filing system in accordance with 37 C.F.R. § 1.6(a)(4):

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

on October 20, 2015 .
Date

/Allison Escobedo/
Signature

Allison Escobedo
Typed or printed name of person signing Certificate

Registration Number, if applicable

(213) 892-5200
Telephone Number

Note: Each paper must have its own certificate of mailing, or this certificate must identify each submitted paper.

Application Data Sheet (7 pages)
Request for Correction of Inventorship under 37 CFR 1.48 (2 pages)
Declarations (10 pages)

LA-1301156

PTO/AIA/01 (06-12)
Approved for use through 01/31/2014. OMB 0651-0032
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DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	WELLNESS AGGREGATOR

As the below named inventor, I hereby declare that:

This declaration is directed to:

- [ ] The attached application, or
- [x] United States application or PCT international application number 14/599,424 filed on January 16, 2015.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

Inventor: **Christopher D. SOLI** Date (Optional): 3-23-15

Signature: Christopher D. Soli

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

Attorney Docket No.: 106842130031 (P23397US3)

sf-3507045

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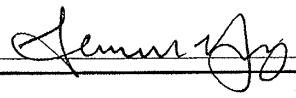
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LEGAL NAME OF INVENTOR

Inventor: **Lawrence Y. YANG** Date (Optional): 3/24/2015

Signature: 

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

Attorney Docket No.: 106842130031 (P23397US3)

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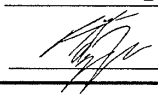
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LEGAL NAME OF INVENTOR

Inventor: **Dennis S. PARK** Date (Optional): March 25, 2015

Signature: 

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

AliveCor Exhibit 1002
AliveCor, Inc. v. Apple Inc.
IPR2023-01434, U.S. Patent No. 10,270,898
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PTO/AIA/01 (06-12)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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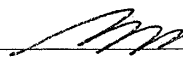
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LEGAL NAME OF INVENTOR

Inventor: Stephen O. LEMAY Date (Optional): _____

Signature: 

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

Attorney Docket No.: 106842130031 (P23397US3)

sf-3507045

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- [X] United States application or PCT international application number 14/599,424 filed on January 16, 2015 .

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

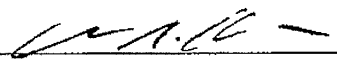
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LEGAL NAME OF INVENTOR

Inventor: Daniel S. KEEN Date (Optional): _____

Signature: 

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

Attorney Docket No. 108842130031 (P23397US3)

sf-3507045

PTO/AIA/01 (06-12)
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DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	WELLNESS AGGREGATOR

As the below named inventor, I hereby declare that:

This declaration is directed to:
- ☐ The attached application, or
- ☒ United States application or PCT international application number 14/599,424 filed on January 16, 2015.

The above-identified application was made or authorized to be made by me.

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LEGAL NAME OF INVENTOR

Inventor: James H. FOSTER Date (Optional): _____

Signature: _____

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- [x] United States application or PCT international application number 14/599,425 filed on January 16, 2015 .

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LEGAL NAME OF INVENTOR

Inventor: **Zachery KENNEDY** Date (Optional): 3-31-15

Signature:

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

AliveCor Exhibit 1002
AliveCor, Inc. v. Apple Inc.
IPR2023-01434, U.S. Patent No. 10,270,898
2001 of 2716

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LEGAL NAME OF INVENTOR

Inventor: Michael O'REILLY Date (Optional): _____

Signature: Michael O'Reilly

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

sf-3507045

Attorney Docket No.: 106842130031 (P23397US3)

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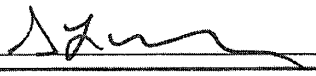
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LEGAL NAME OF INVENTOR

Inventor: Guy L. TRIBBLE Date (Optional): _____

Signature: 

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

AliveCor Exhibit 1002
AliveCor, Inc. v. Apple Inc.
IPR2023-01434, U.S. Patent No. 10,270,898
2003 of 2716

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LEGAL NAME OF INVENTOR

Inventor: **Todd K. WHITEHURST** Date (Optional): 06 May 2015

Signature: Todd K. Whitehurst

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

sf-3507045

Attorney Docket No.: 106842130031 (P23397US3)

Electronic Patent Application Fee Transmittal

Application Number:	14599424
Filing Date:	16-Jan-2015
Title of Invention:	WELLNESS AGGREGATOR
First Named Inventor/Applicant Name:	Christopher D. Soli
Filer:	Jordan Michael Lofdahl/Allison Escobedo
Attorney Docket Number:	106842130031 (P23397US3)

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
PROCESSING FEE, EXCEPT PROV. APPLS.	1830	1	140	140
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**140**

Electronic Acknowledgement Receipt

EFS ID:	23835528
Application Number:	14599424
International Application Number:	
Confirmation Number:	3136
Title of Invention:	WELLNESS AGGREGATOR
First Named Inventor/Applicant Name:	Christopher D. Soli
Customer Number:	119082
Filer:	Jordan Michael Lofdahl/Allison Escobedo
Filer Authorized By:	Jordan Michael Lofdahl
Attorney Docket Number:	106842130031 (P23397US3)
Receipt Date:	20-OCT-2015
Filing Date:	16-JAN-2015
Time Stamp:	14:13:44
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$140
RAM confirmation Number	402
Deposit Account	031952
Authorized User	LOFDAHL, JORDAN
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Request under Rule 48 correcting inventorship	2130031_Req_Corr_Inventorship.pdf	28683 7b269590da7c909c64aae7f994cbfa4dbbb31166	no	2
Warnings:					
Information:					
2	Application Data Sheet	2130031_Corrected_ADS.pdf	26274 72de58cc6af2044b920c859c7ca662c3e6505daa	no	8
Warnings:					
Information:					
This is not an USPTO supplied ADS fillable form					
3	Oath or Declaration filed	2130031_Declarations.PDF	457223 b59a76f89f73c2ba7813436323d8c34dc57582f3	no	10
Warnings:					
Information:					
4	Fee Worksheet (SB06)	fee-info.pdf	30771 29bb3e840322981ab3a93f51657c28bebb83caee	no	2
Warnings:					
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New Applications Under 35 U.S.C. 111

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National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	14599424
	Filing Date	2015-01-16
	First Named Inventor	Christopher D. Soli
	Art Unit	3626
	Examiner Name	Not Yet Assigned
	Attorney Docket Number	106842130031 (P23397US3)

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	6266098	B1	2001-07-24	Cove et al.	
	2	6323846	B1	2001-11-27	Westerman et al.	
	3	6570557	B1	2003-05-27	Westerman et al.	
	4	6661438	B1	2003-12-09	Shiraishi et al.	
	5	6662023	B1	2003-12-09	Helle, Seppo	
	6	6677932	B1	2004-01-13	Westerman, Wayne Carl	
	7	7081905	B1	2006-07-25	Raghunath, Mandayam T.	
	8	7130664	B1	2006-10-31	Williams, Daniel P.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	First Named Inventor	Christopher D. Soli
	Art Unit	3626
	Examiner Name	Not Yet Assigned
	Attorney Docket Number	106842130031 (P23397US3)

	9	7614008	B2	2009-11-03	Ording, Bas	
	10	7633076	B2	2009-12-15	Huppi et al.	
	11	7653883	B2	2010-01-26	Hotelling et al.	
	12	7657849	B2	2010-02-02	Chaudhri et al.	
	13	7663607	B2	2010-02-16	Hotelling et al.	
	14	7844914	B2	2010-11-30	Andre et al.	
	15	7957762	B2	2011-06-07	Herz et al.	
	16	8006002	B2	2011-08-23	Kalayjian et al.	
	17	8050997	B1	2011-11-01	Nosek et al.	
	18	8239784	B2	2012-08-07	Hotelling et al.	
	19	8279180	B2	2012-10-02	Hotelling et al.	

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	20	8381135	B2	2013-02-19	Hotelling et al.	
	21	8479122	B2	2013-07-02	Hotelling et al.	
	22	8666361	B2	2014-03-04	Chu et al.	
	23	6809724	B1	2004-10-26	Shiraishi et al.	

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	1	20020015024	A1	2002-02-07	Westerman et al.	
	2	20050187873	A1	2005-08-25	Labrou et al.	
	3	20050190059	A1	2005-09-01	Wehrenberg, Paul J.	
	4	20050191159	A1	2005-09-01	Benko, John C.	
	5	20060017692	A1	2006-01-26	Wehrenberg et al.	

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	Attorney Docket Number	106842130031 (P23397US3)

	6	20060026536	A1	2006-02-02	Hotelling et al.	
	7	20060033724	A1	2006-02-16	Chaudhri et al.	
	8	20060197753	A1	2006-09-07	Hotelling, Steven P.	
	9	20060294025	A1	2006-12-28	Mengerink, Matthew	
	10	20070135043	A1	2007-06-14	Hayes et al.	
	11	20080320391	A1	2008-12-25	Lemay et al.	
	12	20090036165	A1	2009-02-05	Brede, Steinar	
	13	20090199130	A1	2009-08-06	Tsern et al.	
	14	20090205041	A1	2009-08-13	Michalske, Steven Charles	
	15	20100223145	A1	2010-09-02	Dragt, Bruce	
	16	20110088086	A1	2011-04-14	Swink et al.	

AliveCor Exhibit 1002
AliveCor, Inc. v. Apple Inc.
IPR2023-01434, U.S. Patent No. 10,270,898
2013 of 2716

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	First Named Inventor	Christopher D. Soli
	Art Unit	3626
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	Attorney Docket Number	106842130031 (P23397US3)

	17	20110251892	A1	2011-10-13	Laracey et al.	
	18	20120016678	A1	2012-01-19	Gruber et al.	
	19	20120089507	A1	2012-04-12	Zhang et al.	
	20	20120159380	A1	2012-06-21	Kocienda et al.	
	21	20120258684	A1	2012-10-11	Franz et al.	
	22	20120290449	A1	2012-11-15	Mullen et al.	
	23	20120310760	A1	2012-12-06	Phillips et al.	
	24	20120322370	A1	2012-12-20	Lee, Sang Hoon	
	25	20120322371	A1	2012-12-20	Lee, Sang Hoon	
	26	20130097566	A1	2013-04-18	Berglund, Carl Fredrik Alexander	
	27	20130103519	A1	2013-04-25	Kountotsis et al.	

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	Attorney Docket Number	106842130031 (P23397US3)

	28	20130110719	A1	2013-05-02	Carter et al.	
	29	20130143512	A1	2013-06-06	Hernandez et al.	
	30	20130225118	A1	2013-08-29	Jang et al.	
	31	20130304651	A1	2013-11-14	Smith et al.	
	32	20130332364	A1	2013-12-12	Templeton et al.	
	33	20140074716	A1	2014-03-13	Ni, Yihan	
	34	20140101056	A1	2014-04-10	Wendling, Bertrand	
	35	20140129441	A1	2014-05-08	Blanco et al.	
	36	20140279442	A1	2014-09-18	Luoma et al.	
	37	20140279556	A1	2014-09-18	Priebatsch et al.	
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	1	1052566	EP	A1	2000-11-15	Alcatel		☐
	2	2551784	EP	A1	2013-01-30	Roche Diagnostics GmbH		☐
	3	2006/037545	WO	A2	2006-04-13	Nokia Corporation		☐
	4	2013/169849	WO	A2	2013-11-14	Yknots Industries LLC		☐
	5	2014/105276	WO	A1	2014-07-03	Yknots Industries LLC		☐

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	14599424
	Filing Date	2015-01-16
	First Named Inventor	Christopher D. Soli
	Art Unit	3626
	Examiner Name	Not Yet Assigned
	Attorney Docket Number	106842130031 (P23397US3)

	4	Non-Final Office Action received for U.S. Patent Application No. 14/503,381, mailed on May 13, 2015, 13 pages.	☐
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	6	KAMIJO, NOBORU, "Next Generation Mobile System - WatchPad1.5", Available at "http://researcher.ibm.com/researcher/view_group_subpage.php?id=5617", retrieved on July 4, 2015, 2 pages.	☐
	7	LEMAY et al., U.S Provisional Patent Application No. 60/936,562, filed on June 20, 2007, titled "Portable Multifunction Device, Method, and Graphical User Interface for Playing Online Videos", 61 pages.	☐
	8	NDTV, "Sony SmartWatch 2 Launched in India for Rs. 14,990", available at "http://gadgets.ndtv.com/others/news/sony-smartwatch-2-launched-in-india-for-rs-14990-420319", September 18, 2013, 4 pages.	☐
	9	International Search Report and Written Opinion received for PCT Patent Application No. PCT/US2014/053951, mailed on December 8, 2014, 11 pages.	☐
	10	International Search Report and Written Opinion received for PCT Patent Application No. PCT/US2014/053957, mailed on February 19, 2015, 11 pages.	☐
	11	International Search Report and Written Opinion received for PCT Patent Application No. PCT/US2014/053958, mailed on February 19, 2015, 10 pages.	☐
	12	YANG et al., U.S Provisional Patent Application No. 62/004,886, filed on May 29, 2014, titled "User Interface for Payments", 198 pages. (Copy not attached)	☐
	13	International Search Report and Written Opinion received for PCT Patent Application No. PCT/US2015/019321, mailed on June 3, 2015, 11 pages.	☐
	14	APPLE, "iPhone User's Guide", 2007, 137 pages.	☐

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Signature	/Brian B. Ho/	Date (YYYY-MM-DD)	2015-06-22
Name/Print	Brian B. Ho	Registration Number	60,199

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(54) Graphical user interface

(57) In terminals having a display and a processor system with a graphical interface for allowing a user to access one out of a number applications and/or commands, this number is getting larger and larger. To allow said user to be able to control this large number, said graphical interface should be in the form of a 3-dimensional object to be shown on said display and having several faces for allowing access to several applications and/or commands, whereby said 3-dimensional object should be rotatable in two different directions for allowing at least one of said faces to be shown to said user. Said 3-dimensional object should be larger when used and smaller when not used, preferaby in dependence of a display-location, and should be designed for a window environment.

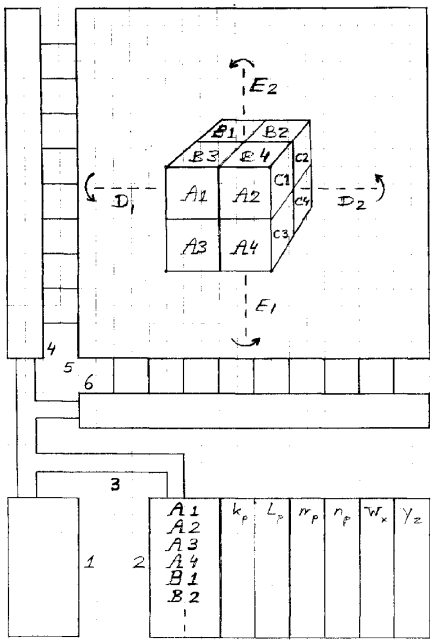


Fig. 1

EP 1 052 566 A1

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Description

[0001] The invention relates to a telecommunication system comprising a display and a processor system being provided with a processor, a memory and a graphical interface for allowing a user to access applications and/or commands, which graphical interface is substantially in the form of a 3-dimensional object to be shown on said display and having several faces for allowing access to several applications and/or commands.

[0002] Such a telecommunication system is known in the form of a personal computer (pc) comprising a computer game which has a control menu in the form of a wheel that can be turned to the left and to the right and that has faces on its surface showing "start game", "load game", "end game" etc. This known graphical interface is a more sophisticated alternative to the well-known ALT TAB function for switching between applications like windows.

[0003] Such a telecommunication system is disadvantageous, inter alia, due to recent telecommunication systems in the form of telecommunication terminals comprising a large number of applications and/or commands making it very difficult to a user to select quickly one of said large number of applications and/or commands.

[0004] It is an object of the invention, inter alia, to provide a telecommunication system as described in the preamble, which allows a user to more quickly select one out of a large number of applications and/or commands.

[0005] Thereto, the telecommunication system according to the invention is characterised in that said 3-dimensional object is rotatable in at least two different directions for allowing at least one of said faces to be shown to said user.

[0006] By allowing the 3-dimensional object to be rotatable in at least two different directions, it can be in the form of a cubic or a pyramid, for example, thereby allowing a large number of faces to be quickly selectable by a user.

[0007] The invention is based on the insight, inter alia, that when displays get smaller and/or the number of applications and/or commands increases, information should also be put in a third dimension, in addition to the first and second dimension, to allow a maximum number being accessable.

[0008] The invention solves the problem, inter alia, of giving a user access to a large number of applications and/or commands in a very user-friendly way.

[0009] A first embodiment of the telecommunication system according to the invention is characterised in that at least one dimension of said 3-dimensional object can be increased and/or decreased.

[0010] By increasing at least a part of said 3-dimensional object, for example after activation of it, and decreasing at least a part of said 3-dimensional object, for example after deactivation of it, the user-friendlyness is increased.

[0011] A second embodiment of the telecommunication system according to the invention is characterised in that said increasing and/or decreasing is display-location dependent.

[0012] By introducing a display-location dependency, for example after activation said 3-dimensional object could be moved automatically or by a user to the centre of the display and enlarged, and for example after deactivation said 3-dimensional object could be moved automatically or by a user to a corner of the display and made smaller.

[0013] A third embodiment of the system according to the invention is characterised in that said processor system is adapted for a window environment.

[0014] In this case said 3-dimensional object could be either shown in each window or in one window only or in some windows, and at least a part of the applications to be accessed via said 3-dimensional object could correspond to one or more windows.

[0015] A fourth embodiment of the system according the invention is characterised in that said memory comprises first signals for displaying said 3-dimensional object on said display and comprises second signals for activation of said applications and/or commands corresponding with said faces of said object, and in that said processor is adapted for, in response to control signals originating from said user, processing said first and second signals for rotating said 3-dimensional object in at least two directions for allowing at least one of said faces to be shown to said user for said activation.

[0016] In this case first signals are used for displaying purposes and second signals are used for activation purposes, whereby some couplings and/or relationships could exist between said first and second signals.

[0017] A fifth embodiment of the system according the invention is characterised in that said first signals comprise at least dimension signals, of which at least one dimension signal can be increased and/or decreased.

[0018] In this case dimension signals are used for increasing and/or decreasing purposes.

[0019] A sixth embodiment of the system according the invention is characterised in that said first signals comprise at least display-location signals, with said increasing and/or decreasing of at least one dimension signal being dependent upon at least one display-location signal.

[0020] In this case display-location signals are used for introducing said display-location dependency.

[0021] A seventh embodiment of the system according the invention is characterised in that said memory comprises window signals for a window environment.

[0022] In this case window signals are used for creating a window environment, whereby some couplings and/or relationships could exist between said window signals and said first and/or second signals.

[0023] The invention further relates to a processor system comprising a processor, a memory and a graph-

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ical interface for allowing a user to access applications and/or commands, which graphical interface is substantially in the form of a 3-dimensional object to be shown on said display and having several faces for allowing access to several applications and/or commands.

[0024] The processor system according to the invention is characterised in that said 3-dimensional object is rotatable in at least two different directions for allowing at least one of said faces to be shown to said user.

[0025] The invention yet further relates to a graphical interface for allowing a user to access applications and/or commands, which graphical interface is substantially in the form of a 3-dimensional object to be shown on a display and having several faces for allowing access to several applications and/or commands.

[0026] The graphical interface according to the invention is characterised in that said object is rotatable in at least two different directions for allowing at least one of said faces to be shown to said user.

[0027] The document EP 352741 discloses a 3-dimensional graphical interface having several colors, it does not disclose the telecommunication system according to the invention. All references including further references cited with respect to and/or inside said references are considered to be incorporated in this patent application.

[0028] The invention will be further explained at the hand of an embodiment described with respect to a drawing, whereby

figure 1 discloses a processor system according to the invention and a display showing a graphical interface according to the invention.

[0029] The processor system according to the invention shown in figure 1 comprises a processor 1, a memory 2, a bus 3, a display 5 coupled to a first driver 4 and to a second driver 6, whereby processor 1, memory 2, driver 4 and driver 6 are coupled via said bus 3.

[0030] Display 5 shows a graphical interface according to the invention being formed by a cubic having six sides or main-faces of which main-faces A, B and C are shown, each side comprising 4 faces (A: A1,A2,A3,A4; B: B1,B2,B3,B4; C: C1,C2,C3,C4), which cubic can be rotated via horizontal axis D (D1: towards a user, D2: from a user) and via vertical axis E (E1: to the right, E2: to the left).

[0031] Memory 2 is in the form of a table memory comprising at least 7 columns, the first column for storing face-indication signals (A1,A2,A3,A4,B1,B2 etc.), the second column for storing display-location signals (Kp: indicating one point of a face, for example the centre or one of the corners of said face), the third column for storing first direction signals (Lp: indicating a first side of a face by an angle, for example face A1 having a first side at zero degrees), the fourth column for storing second indication signals (Mp: indicating a second side of a face by an angle, for example face A1 having a second side at ninety degrees), the fifth column for storing dimension signals (Np: indicating a dimension of a face, for example the length of the side of a face), the sixth column for storing window signals (Wx: indicating in which window (s) the graphical interface is shown) and the seventh column for storing application/command signals (Yz: indicating which application (like for example text processing or presentation-sheet processing) and/or command (in text processing for example an overwrite function or store-text function or load-text function) can be activated by the corresponding face).

[0032] The processor system according to the invention comprising the graphical interface according to the invention functions as follows. The processor system comprises a software program that runs in processor 1 at the hand of the data in memory 2 whereby said data is exchanged via bus 3. This results in processor 1 sending information via bus 3 to drivers 4 and 6, which drive display 5 in such a way that said cubic is displayed.

[0033] According to a first embodiment, a user would like to activate an application shown/defined by face A1. To do this, said user moves his cursor (for example via mouse or keyboard or touch screen) to face A1 and clicks on the mouse or presses 'RETURN' or 'ENTER' on his keyboard or presses on the touch screen. Then location-information from said cursor and present in processor 1 is compared with the content of memory 2 via bus 3, for example by calculating at the hand of the signals stored in each row in the second, third, fourth and fifth column whether a location as defined by said location-information is situated inside or outside each face, resulting in finding face A1 to be the one selected by said user. Then processor 1 searches for the application and/or command corresponding to face A1, for example by reading the content in the seventh column of the row corresponding with face A1, and this application and/or command is activated.

[0034] According to a second embodiment, a user would like to activate an application not shown and defined by face F1. To do this, said user moves his cursor (for example via mouse or keyboard) to at least one of said axis D1, D2, E1 and E2, and clicks on the mouse or presses 'RETURN' or 'ENTER' on his keyboard. Then location-information from said cursor and present in processor 1 is recognised as an instruction to rotate said cubic, and said software program that runs in processor 1 at the hand of the old data in memory 2 calculates new data replacing said old data. This results in processor 1 sending information via bus 3 to drivers 4 and 6, which drive display 5 in such a way that said cubic is now displayed in a rotated way, thereby showing face F1. Then said user moves his cursor (for example via mouse or keyboard) to said face F1, and clicks on the mouse or presses 'RETURN' or 'ENTER' on his keyboard. Then location-information from said cursor and present in processor 1 is compared with the content of memory 2 via bus 3, for example by calculating at the hand of the signals stored in each row in the second, third, fourth and fifth column whether a location as defined by said location-information is situated inside or outside each

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face, resulting in finding face F1 to be the one selected by said user. Then processor 1 searches for the application and/or command corresponding to face F1, for example by reading the content in the seventh column of the row corresponding with face F1, and this application and/or command is activated.

[0035] According to a third embodiment, a user would like to activate an application shown/defined by face B1 or C1. Then there are two possibilities. Either this is allowed by said processor system, in which case the procedure belonging to embodiment 1 is followed, or this is not allowed by said processor system, in which case the procedure belonging to embodiment 2 is followed. The fact that this activation is allowed or not can easily be defined by for example the content of the third and fourth columns: only faces A1, A2, A3 and A4 will show an angle of zero degrees and an angle of ninety degrees, faces B1, B2, B3 and B4 will show angles of for example zero degrees and fortyfive degrees, and faces C1, C2, C3 and C4 will show angles of for example fortyfive degrees and ninety degrees. In view of this information, said software program can be designed to be able to decide what is allowed or not.

[0036] According to a fourth embodiment, a user would like to move said cubic towards for example the right upper corner of display 5. To do this, said user moves his cursor (for example via the mouse) to for example the common point of faces A1, A2, A3 and A4, and clicks on the mouse and keeps it in clicked position. Then location-information from said cursor and present in processor 1 is recognised as an instruction to move said cubic, and said software program that runs in processor 1 at the hand of the old data in memory 2 calculates new data replacing said old data. This results in processor 1 sending information via bus 3 to drivers 4 and 6, which drive display 5 in such a way that said cubic is now displayed in the right upper corner of display 5. According to an alternative, said software program is such that a double click is sufficient to automatically move said cubic to said corner and (after an other double click) back, whereby different locations are predefined and adaptable by said user.

[0037] According to a fifth embodiment, in addition to said fourth embodiment, when said software program that runs in processor 1 at the hand of the old data in memory 2 calculates new data replacing said old data, the content of the fifth column is changed also, in such a way that dimension signals are made smaller when said cubic is moved towards said corner and are made bigger when said cubic is moved towards the centre of display 5. According to an alternative, said software program is such that a double click is sufficient to automatically move said cubic to said corner and (-after an other double click) back, whereby different locations and/or different sizes are predefined and adaptable by said user.

[0038] According to a sixth embodiment, in a window environment, it is defined per window which faces can be activated or not, whether or not per window said graphical interface is shown, and where per window said graphical interface has its locations with respect to activated and deactivated situations, whereby the sixth column could be used (possibly together with other columns) of memory 2 to indicate this. Further, by adding one or more rows to the row that corresponds with a face, different graphical interfaces can be shown in different windows, for example a cubic in a first window and a pyramid in a second window.

[0039] Everything described before could be made dependent upon a user-identification (by password, smart card, fingerprint, voice detection etc.) to introduce more user-friendlyness by allowing several users to have their own preferences, and/or could be made dynamically by detecting what a user or users are doing and in dependence of that adjusting signals automatically, for example by showing a cubic to a user in such a way that the faces that have been activated more often than others can be activated without the need to rotate, whereby said other faces can only be activated after rotation.

[0040] As described before, said graphical interface could have several forms (cubic, pyramid etc.), and could even have a different form per window, whereby it should not be excluded that a user will get the possibility to create an individual graphical interface. Such a graphical interface could be controlled by mouse, keyboard, scrolling keys, touch screen or even voice.

[0041] All embodiments are just embodiments and do not exclude other embodiments not shown and/or described. For example, memory 2 could be an other memory differing from said table memory and for example based on addresses, and instead of the described low level implementation a higher level implementation belongs to the possibilities, without departing from the general inventive concept that said graphical interface is substantially in the form of a 3-dimensional object to be shown on a display and having several faces for allowing a user access to several applications and/or commands, whereby said 3-dimensional object is rotatable in at least two different directions for allowing at least one of said faces to be shown to said user.

Claims

1. Telecommunication system comprising a display and a processor system being provided with a processor, a memory and a graphical interface for allowing a user to access applications and/or commands, which graphical interface is substantially in the form of a 3-dimensional object to be shown on said display and having several faces for allowing access to several applications and/or commands, characterised in that said 3-dimensional object is rotatable in at least two different directions for allowing at least one of said faces to be shown to said user.

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2. Telecommunication system according to claim 1, characterised in that at least one dimension of said 3-dimensional object can be increased and/or decreased.

3. Telecommunication system according to claim 2, characterised in that said increasing and/or decreasing is display-location dependent.

4. Telecommunication system according to claims 1, 2 or 3, characterised in that said processor system is adapted for a window environment.

5. Telecommunication system according to claims 1, characterised in that said memory comprises first signals for displaying said 3-dimensional object on said display and comprises second signals for activation of said applications and/or commands corresponding with said faces of said object, and in that said processor is adapted for, in response to control signals originating from said user, processing said first and second signals for rotating said 3-dimensional object in at least two directions for allowing at least one of said faces to be shown to said user for said activation.

6. Telecommunication system according to claim 5, characterised in that said first signals comprise at least dimension signals, of which at least one dimension signal can be increased and/or decreased.

7. Telecommunication system according to claim 6, characterised in that said first signals comprise at least display-location signals, with said increasing and/or decreasing of at least one dimension signal being dependent upon at least one display-location signal.

8. Telecommunication system according to claims 5, 6 or 7, characterised in that said memory comprises window signals for a window environment.

9. Processor system comprising a processor, a memory and a graphical interface for allowing a user to access applications and/or commands, which graphical interface is substantially in the form of a 3-dimensional object to be shown on said display and having several faces for allowing access to several applications and/or commands, characterised in that said 3-dimensional object is rotatable in at least two different directions for allowing at least one of said faces to be shown to said user.

10. Graphical interface for allowing a user to access applications and/or commands, which graphical interface is substantially in the form of a 3-dimensional object to be shown on a display and having several faces for allowing access to several applications and/or commands, characterised in that said object is rotatable in at least two different directions for allowing at least one of said faces to be shown to said user.

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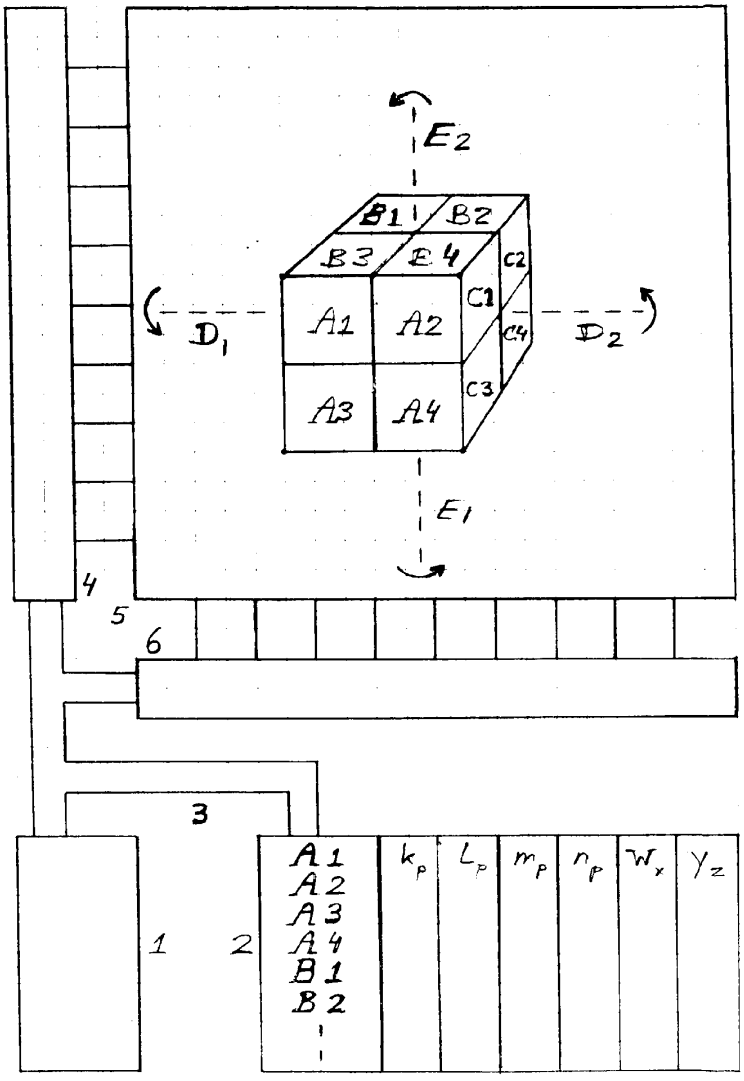


Fig. 1

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EUROPEAN SEARCH REPORT

Application Number
EP 99 44 0112

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	US 5 678 015 A (GOH ENG LIM) 14 October 1997 (1997-10-14) * abstract * * column 4, line 26 - line 34 * * column 5, line 12 - line 49; figure 4 * * column 5, line 62 - column 6, line 5; figure 5 * * column 6, line 14 - line 47 * ---	1-10	G06F3/033
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	20 October 1999	Bravo, P

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological backgro.ind
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T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
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European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 99 44 0112

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 99 44 0112

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The members are as contained in the European Patent Office EDP file on
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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(54) Method of controlling the display of a dataset

(57) Disclosed is a medical system, comprising a display and wherein in response to the reception of triggering information, a subset of data is selected from a displayed or non-displayed dataset according to a data priority scheme and wherein the displayed dataset is replaced by the display of the selected subset of data. The display of the selected subset of data uses a variety of rendering options. The triggering information is provided by the user of provided by one or more sensors. The data priority scheme is predefined or computed. It is static or dynamic. The data priority scheme can comprise a threshold which is applied for the selection or determination of the subset of data. Examples of priorities associated with data for diabetes care are provided. A range of display means can be used and combined.

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Description

[0001] Examples are described of controlling the display of a dataset. Specifically, there are disclosed methods and systems of selecting, adapting or optimizing the display of a selected subset of a dataset.

Background

[0002] Patent application US2010/0167385 entitled "User interface features for an electronic device" discloses a method for controlling a display device of an electronic device. According to this document, a data field may be displayed on the display device. An editing process may be executed that provides for editing of the data field displayed on the display device. The data field on the display device may be magnified relative to other portions of the display device when selected for editing according to the editing process.

[0003] Other existing solutions for enhanced readability present drawbacks and limitations.

[0004] There is a need for improvements of current methods and systems, in particular for visually impaired persons.

Summary

[0005] There are disclosed methods and systems of selecting a subset of data of a dataset, automatically or on demand, and of adapting or optimizing the display of the selected subset of data according to certain data priority schemes. There are provided contextual and/or proactive display methods and systems.

[0006] The medical product related to the present patent application is the first insulin pump brought to the market which is provided with zoom functionality, corresponding to one embodiment of disclosed methods and systems.

[0007] Examples are provided to adapt the display of data to specific contexts. Regarding the form, a modified display occurs either on demand or automatically. The display of data is managed according to certain technical parameters, predefined or not, static or dynamic, optionally retrieved in real-time. Optional sensors (and the combinations thereof) lead to appropriate displays of particular data. Regarding the substance, a selection process of a subset of data is described. Form and substance being intermingled, the methods and systems presently described do accordingly combine the appropriate use of triggering information, the appropriate selection processes or definition of data priority schemes and the appropriate presentation of information determined and enabled by technical means.

[0008] Effects or advantages or objectives relate to enhanced readability, better downstream human decisions, gain of time due to faster access to contextually relevant information, increased ease of use due to increased relevancy of the displayed data, increased comfort, contextual provision of data, better security, increased medical safety, etc. The absolute relevancy or contextual/relative relevancy is being appreciated with respect to the environment of the user (noisy or quiet, dark or light, etc) or with respect to the context (activities) in which the user is (night or day, work, lunch time, calendar day and habits) or even with respect to the state of the user (sleeping, just awakening, working, relaxing, etc) for example.

[0009] The disclosed methods and systems benefit in particular to visually impaired persons, but not only. Embodiments of the present invention benefit to several types of persons or audiences:

- Sick persons; for example, anemic patients track their blood oxygen levels and want to be notified about contextually relevant information. Likewise, cardiac persons are alerted in case of increased probability of faintness.

- Persons with chronic diseases, and diabetes in particular; some diabetics are visually impaired, since over the years the chronic disease may have caused harm to their eyes and in particular to their retinas. Persons with diabetes having normal vision capabilities also benefit from the present disclosure. In everyday life, a better user interaction with the insulin pump or other components of a insulin delivery system (for example, a remote control device such as a blood glucose meter having remote control capabilities for controlling the operation of the pump) provides more comfort. The vision capabilities of these persons being diminished, a particular handling of the management of the display of the data is required;

- The elderly; in developed countries, the aging of the population is associated with more frequent vision problems. The agility with user interfaces also diminishes. Therefore, more simple and effective user interfaces are needed. The present methods and systems enable the provision of effective user interfaces;

- Children; in some situations, users or patients may be very young. Adapted display methods and systems, particular user interaction are required. Sustained attention capabilities and educational levels may lead to a particular style of communication, for example with icons and/or with images and/or with videos and/or with figures and/or with a combination thereof;

- Healthy individuals; these persons also have an interest in the disclosed methods and systems for preventive medicine or fitness monitoring purposes for example. For example, a person practicing sports, such as a cyclist, may closely monitor his sodium levels to prevent dehydration. A person practicing

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jogging may monitor his heart rate and be notified of relevant information. While practicing sport, there is little time for looking at the display of data on display devices. Audio signals such as text to speech lectures of heart rate for example may not be convenient enough in noisy environments. A visual display remains useful but said display has to be optimized regarding a set of parameters (user profile, date and time, data characteristics, display characteristics, etc). Preventive or personalized medicine may implement present methods and systems. For example, a person presenting risks regarding cholesterol levels would be interested in appropriate prompts of measured levels (continuous monitoring basis or intermittent basis), in order to modify his behavior at certain particular moments in life (lunches) ;

- soldiers or police or military forces; on the battlefield, the continuous monitoring of toxic agents and the associated optimized display of information would result in increased survival chances. Applications correspond to the remote sensing of airborne bacteria e.g. in counter-bioterrorist activities (detection of pathogens) or to the determination or handlings of levels of toxic substances before and after bioremediation;

[0010] Optimized displays can thus intervene at special moments, particular moments, episodic moments, regular moments or even random moments (form). The presentation of information can be optimized according to a technical logic and by technical means. Contents can be optimized (substance).

Brief description of the figures

[0011]

Figure 1: system view and architectural choices, corresponding to different embodiments;

Figure 2: overview and workflow of the method;

Figure 3: electronic device such as an insulin pump provided with a display screen and a touch sensitive surface for triggering a zoom function;

Figure 4: example of the data displayed on a display screen which is part of an insulin pump or of a networked medical device part of a medical system for example;

Figure 5: examples of possible selections of the subset of data and the further modifications brought to the original displayed dataset;

Figure 6: other modes of display for enhanced readability;

Figure 7: an example of a full-screen optimization;

Figure 8: examples of a data priority scheme, which can be static or dynamic (not shown);

Figure 9: examples of different embodiments and architectural choices, with different triggering information interfaces and/or different display devices and/or different communication modes;

Figure 10: other embodiments, with display devices such as a TV of car windscreen for example;

Figure 11: example of a head-mounted display embodiment;

Figure 12: example of a retinal display embodiment.

Detailed description

[0012] Values provided in the present description and/or figures are only examples which may cause injuries or death if inappropriately applied.

[0013] The figure 1 shows a system view and architectural choices for implementing disclosed methods in/or systems.

[0014] The figure comprises a network 100 ; computing and storage resources 110 ; regulation, rules and social rules or features 120 ; data management processes and associated logic 130 ; a set of body sensors 140 ; display means 150 ; inputs devices or interfaces 160 ; contextual or ambient sensors 170.

[0015] The network 100 may be any kind of networks, such as Internet, Intranet, Wi-Fi, or a mesh network (ad-hoc network) for example. It can correspond in particular to the network enabling a system of networked medical devices.

[0016] Computing resources and storage resources 110 are associated with processors and storage or memory units. These resources can be local (physical implementation of said resources in the drug infusion device for example) or remotely accessed (through the network, in the "cloud" for example). An insulin pump today comprises a processor and a memory unit, for example. In the future, such an insulin pump may correspond to a thin client which is controlled in/by the cloud.

[0017] The rules 120 may comprise regulation rules provided by regulatory authorities. Such rules may be provided in the form of pieces of software code provided through the network (firmware and/or software and/or hardware embodiments). Other rules can be shared by communities of patients (leveraging social features and sharing of experiences through the network). For example, such a rule might read "if it is 11 am and the blood glucose measure is below 70, then verify the continuous monitoring sensor". Such rules may be updated with firmware updates of the pump (or of any networked medical devices of the medical system, sharing such rules

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within the system). Other embodiments correspond to hardware embodiments (i.e. storage in ROM or USB sticks for example).

[0018] The data management processes or logic 130 can operate or occur in the cloud or locally, such as in a medical infusion pump. It comprises a priority scheme. Said data priority scheme can comprise a knowledge base of facts, a set of rules, priority ranks, or other components. The priority scheme can be static (i.e. the components do not evolve over time) but it may also be dynamic (priority ranks evolve over time, and/or are responsive to local events and/or regulation rules and/or user profiles or preferences and/or contextual data and/or environmental data and/or ambient data). The priority scheme will be described in detail in figure 8.

[0019] Body sensors 140 can form a so-called Body Area Network (BAN) or Body Sensor Network (BSN). Body sensors comprise wearable and/or implementable and/or wireless (bio) sensors adapted to assess physiological state of the user or patient. These sensors can monitor said physiological state continuously or not (on demand or upon action of the user). For example, the following parameters can be monitored: blood glucose, heart rate, body temperature, ECG, EEG, EMG, sweat, blood cholesterol, blood alcohol, coagulation, and estimation of physical exercise or carbs consumption (such as evaluated by accelerometers or pedometers for example).

[0020] Body sensors can comprise:

- Accelerometer/gyroscope: an accelerometer is used to recognize and monitor body posture, such as sitting, kneeling, crawling, laying, standing, walking and running. Such ability is essential to many applications, including virtual reality, healthcare, sports and electronic games. The accelerometer-based posture monitoring for BANs typically consists of 3-axis accelerometers (or tri-axial accelerometers) which are placed on some strategic locations on a human body. They can also be used to measure the vibration, as well as acceleration due to the gravity. Gyroscope is used for measuring or maintaining orientation, based on the principle of conservation of angular momentum. Gyroscopes can be used together with accelerometers for physical movement monitoring;

- Blood glucose (BG): it is also called blood sugar and is the amount of glucose circulating in the blood. Traditionally, glucose measurements are done by pricking a finger and extracting a drop of blood, which is applied to a test strip including chemicals sensitive to the glucose in the blood sample. An optical or electrochemical detector (glucometer) is used to analyze the blood sample and gives a numerical glucose reading. Recently, non-invasive glucose measuring devices that monitor BG through infrared technology and optical sensing have become available;

- Blood pressure: the blood pressure sensor is a non-invasive sensor designed to measure systolic and diastolic human blood pressure, utilizing the oscillometric technique;

- CO2 gas sensor: it measures gaseous carbon dioxide levels to monitor changes in CO2 levels, as well as to monitor oxygen concentration during human respiration;

- ECG sensor: ECG is a graphic record of the heart's electrical activity. Healthcare providers use it to help diagnose a heart disease. They can also use it to monitor how well different heart medications are working. In order to obtain an ECG signal, several electrodes are attached at specific sites on the skin (e.g., arms, and chest), and the potential differences between these electrodes are measured;

- EEG sensor: it measures the electrical activity within the brain by attaching small electrodes to the human's scalp at multiple locations. Then, information of the brain's electrical activities sensed by the electrodes is forwarded to an amplifier for producing a pattern of tracings. Synchronous electrical activities in different brain regions are generally assumed to imply functional relationships between these regions. In a hospital, the patient may be asked to breathe deeply or to look at a flashing light during the recording of EEG;

- EMG sensor: it measures electrical signals produced by muscles during contractions or at rest. Nerve conduction studies are often done together while measuring the electrical activity in muscles, since nerves control the muscles in the body by electrical signals (impulses), and these impulses make the muscles react in specific ways. Nerve and muscle disorders cause the muscles to react in abnormal ways;

- Pulse Oximetry: it measures oxygen saturation using a non-invasive probe. A small clip with a sensor is attached to the person's finger, earlobe, or toe. The sensor gives off a light signal that passes through the skin. According to the light absorption of oxygenated hemoglobin and total hemoglobin in arterial blood, the measurement is expressed as a ratio of oxygenated hemoglobin to the total amount of hemoglobin;

- Humidity and temperature sensors: they are used for measuring the temperature of the human body and/or the humidity of the immediate environment around a person. An alarm signal can be issued if a certain amount of changes are measured;

- Image of video sensors: by computer vision, data can be extracted or inferred from data streams.

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[0021] The data or signals provided by these sensors are integrated by a central logic (not shown), which defines a global assessment of the state of the patient: sleeping, just awakened, having lunch, tired, relaxed, busy, energized, euphoric, drunk, etc. External or exogenous parameters such as calendar data and/or time data can be efficiently combined and used in order to increase the probability of accuracy of the assessment. Real examples and situations will be provided in figure 2.

[0022] Display means 150 can be such as a screen of an insulin pump, a screen of a continuous glucose monitoring CGM-based device, a screen of a remote controller, a screen on a watch, a television, a screen of the smart phone, a tablet PC, a PC screen, a headed-mounted display, a retinal projector display, a display projected on a car windscreen (augmented reality), a traditional projector, a projector beaming an image on a wall or on any other surface with appropriate geometrical corrections in response to the deformations of the projecting surface etc. It is important to note that a combination of screens or display means can be used simultaneously. In other words, data displayed to the user can be distributed across several different devices. A blood glucose value can be displayed on a screen at immediate proximity of the patient while information of secondary importance can be displayed on other devices according to an opportunistic approach. Such an example will be detailed in figure 10.

[0023] Inputs means 160 comprise devices such as one or more physical buttons, a touchscreen or a portion thereof, a device adapted to voice recognition, and eye-tracking device, etc. A wide range of haptic devices can also be used, and such devices also include motion gestures analysis or interpretation. Said devices can be combined with one another (multimodal interaction). For example, a voice command can be confirmed or modulated by an action on a touch sensitive interface.

[0024] Contextual sensors 170 are sensors which can be present in the environment (RFID tags providing GPS information, nutritional values of meals, etc) or being weared by the patient. Some may also be implemented in the body of the user. These sensors are such as a sensor adapted to assess the current lighting conditions (night, dark, sunny, etc), a sensor adapted to probabilistically assess or classify the ambient audio level (restaurant, nightclub, working environment, sleeping room, outdoor activities assessed by the presence of wind sounds for example, indoor activities assessed by the presence of particular acoustic responses or audio signals such as music for example), a sensor adapted to determine a geographical location such as a GPS sensor for example, a sensor adapted to perform human face detection (the device can continuously monitor this parameter in order to provide an appropriate response upon the detection of the face of the user looking at the medical infusion device for example), a sensor adapted to evaluate the distance to the eye of the user - a user looking at the insulin pump screen will need different enlargements if standing at 1 m (during the day) compared to 10 centimeters (during the night) for example, a sensor adapted to detect the breath of the user (when said user stands very close to the device, for example during the night). The sensors mentioned above can be combined. For example, the proximity of the user face can be confirmed by the detection of the breath of the user in the proximity of the sensor.

[0025] The sensors described above (contextual and body sensors) can be combined together. For example, a blood glucose sensor can integrate with a sensor adapted to assess the current lighting conditions and lead to the display of some particular data, in a particular manner.

[0026] Some or all of the above architectural elements can be in interaction with each other. For example, the data management processes or logic can be influenced by ambient sensors but also by rules 120 input by a user or a healthcare provider, or even retrieved from the network 100. For example, such rules 120 can be open source rules provided by communities of users or patients.

[0027] In one embodiment, the disclosed method and system can take the form of a *local* medical system which is totally independent from a network and may comprise a drug delivery system, such as a patch pump attached to the skin of a user or patient, a remote controller of said delivery system (for example, having the display, shape and design of a smart phone). According to such an embodiment, computing and storage resources are local, i.e. physically present in the delivery system and/or in the remote controller. In this view, the display is most likely to be present on the remote controller, since the delivery device is desired to be as small as possible (yet a flexible screen may be incorporated on a micro-pump for example). These are mainly autonomous systems.

[0028] According to another embodiment, computing and storage resources are located in the cloud (in one or more servers accessible by one or more communication channels to a medical system). The local device, namely an infusion device, comprises the core medical features (drug reservoir, source of energy, motor or equivalent, injection and/or withdrawal means for continuous or intermittent monitoring for example). It may further comprise communication capabilities (according to continuous or episodic or intermittent or even opportunistic modes). In other words, computing means (processor) and storage (memory unit) are remotely accessed. According to this view, the display embodiment remains mostly unchanged. The rendering of the data to be displayed may be handled in the cloud. The local display device then acts as a display device (i.e. the images being communicated to the local display device are uncompressed and do not need local processing steps). Of course, as discussed, numerous intermediate embodiments or variants are possible. For example, some processing capabilities (image processing such as uncompressing capabilities for example) may be present

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at the local level.

[0029] The embodiments discussed above where computing and storage resources are local or found in the cloud are two extremes.

[0030] Many intermediate embodiments with a different allocation of computing and storage resources between a (networked) device and the cloud are possible. For example, in some embodiments, computing and storage resources used to monitor and safely operate a medical device might be local, whereas computing and storage resources of the cloud are utilized for analyzing medical data to provide a user with tools for improving their lives. In another example, a set of networked medical devices are used. A glucometer with the look and feel of a mobile phone (or a mobile phone having a hardware extension providing glucose measurement capabilities) acts as the central device. It commands a pump (a micropump or patch-pump attached to the skin of the user, or a pump weared at a belt by the patient, or as a pager, etc), which itself communicates with a continuous monitoring device. The two devices (pump and continuous monitoring devices) can be integrated into one. A web platform can retrieve the data collected by one or more considered devices, in order to perform correlation operations (data of one individual can be compared to other data of other patients or to historical data, for statistical purposes, etc). A patient can upload his personal data on demand, or the process can happen automatically (in continuous, on-the-fly or intermittently). A PC accessing the platform may display certain type of information or enable the user to setup the data priority scheme and to share it on social networks.

[0031] Data (personal data, profile data, displayed data, rules, facts, etc) can be distributed over the local networked devices and/or in the cloud. The data priority scheme can be downloaded from the cloud, and/or merged with a local data priority scheme, and/or be locally defined, and/or be dynamically defined. Each networked device may have its own data priority scheme. Or alternatively networked devices may share a common data priority scheme, centralized or distributed. Rules, priority tasks or data can be present in firmware or in software or in hardware or in a combination thereof. Even processing resources or storage resources can be so distributed. Distributed computing enable networked devices to cooperate. If the CPU capabilities of the pump are saturated, it is possible to use processing capabilities of the remote controller for example. Processing tasks can be shared between devices or switched from a device to another. Likewise, storage also can be distributed. A networked USB key of the patient can serve as a hard drive for the pump, or as a key for decryption of data, etc.

[0032] The same remarks apply for the display devices. One main screen or display may handle the display of all or part of the data, but several displays may handle in cooperation the "global" display (i.e. the interaction towards the user). The glucometer may display some type of information (such as blood glucose and basal information), while the pump would "specialize" in maintenance information. The CGM based device (continuous monitoring device) would only display blood glucose and probabilistic expected evolution of the glucose level. The present method is of advantage for said CGM device. When the blood glucose is decreasing too rapidly, this acts as the "triggering information". Either the CGM magnifies the current measurement either it sends a command for magnification (or any other rendering effect) to the central display implemented on the pump and/or on the remote controller and/or glucometer. Prompts can be remotely commanded (parents of the child with the chronic disease may be prompted by an active window surging on their desktop, because of a triggering information such as a fast decrease in blood glucose).

[0033] Online and offline modes of the medical system (and/or of each one of the medical devices part of said system) are possible. The networked devices may indeed operate according to online and/or offline modes. Data caching may enable the devices to be autonomous.

[0034] The figure 2 shows an overview and workflow in an embodiment of the disclosed method that can be implemented in an embodiment of a disclosed system. The figure 2 comprises a network 100, one or more devices 200 (for example, one or more of a medical infusion pump, a remote control device such as a blood glucose meter functioning as a remote control, a continuous blood glucose monitor, a smart phone functioning as a remote control, or a computer for programming the medical infusion pump), a life situation assessment logic 201 accessing data of a clock 202 (night or day, lunchtime, etc), of a calendar 203 and of the user profile 204, a display logic 210, a data priority scheme or model 250, a Triggering Information device or system or surface or command 220.

[0035] A display logic 210 controls the displaying means of the devices 200. It integrates the data provided by the life situation assessment logic 201, optionally with data associated with the triggering information 220 and/or with the data priority scheme 250.

[0036] Regarding the nature and possible embodiments of the triggering information unit 220, it is possible to distinguish two main modes:

a) "on demand" mode

[0037] According to this embodiment, a zoom function is triggered by user actions on a physical button for example. Alternatively, the user can shake the device. The accelerometer would then interpret this motion as the need or request for displaying the most important data, namely current blood glucose level and/or basal rate. The user also can trigger such a display by a particular action on the touchscreen. Alternatively, voice or sound commands captured by a microphone can trigger such data display.

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b) "automatic" mode

[0038] Aside a triggering information coming explicitly from the user (reactive mode), an automatic mode (proactive mode) presents many advantages. Among other benefits, the comfort of use is increased. The efficiency of the interaction of the user with the device is increased. According to such an embodiment, the system permanently adapts to the user activities or context or environment. For example, a camera incorporated on the medical device can estimate the mood of the user, or the distance to his face, or estimate the field of vision and provide appropriate responses. Another example: if the accelerometer history indicates that the patient is confused (number of accelerations recorded by the accelerometer above a certain predefined threshold for example), and/or in hypoglycemia state (which may cause the vision to be troubled) the medical system will display some predefined specific data. This automatic mode is enabled by a cooperation of sensors.

[0039] The triggering information unit 220 is thus associated to two main modes of operation (but intermediate modes remain possible). According to a first "on demand" mode 230, user data is received from the user interface or from an input device or from a haptic device 231 (or from a physical button 232). According to a second "automatic" mode 240, data is retrieved or received from body sensors 241 and/or environment sensors and/or contextual sensors 242.

[0040] The data priority scheme 250 is associated with facts (numerical values) or knowledge base of facts 251, and/or with rules 252.

[0041] Display 210, user input 220 and data model 250 are intermingled or combined. Relationships between these three abstractions are associated with concepts such as influence, feedback, ponderation, limitation, activation, deactivation, control or command. For example, the data priority scheme 250 can influence or drive or control the display logic 210. For example, if a hypoglycemia probability or event is determined, associated alerts or values will preempt or replace any other display data. The data priority scheme 250 for example also can limit or control the Triggering Information unit (not shown). For example, a top priority being previously allocated to the basal rate would lead to the display of basal related data in case of any information received from the triggering information units 220 (any input device thereof). In other words, some user interactivity options may be deactivated or modified according to a certain state of the data priority scheme. In some cases, whatever sensors used by the user, the response in terms of displayed data will be the same (panic situation). According to others situations, different display responses will be provided in correspondence to different inputs means. Likewise, the display logic 210 can restrict the data priority scheme 250 and/or command or control the triggering information unit. For example, a displayed alert of a severe hypoglycemia event may require a user confirmation before any other type of data can be further displayed.

[0042] A particular exploitation of time and date retrieved from the clock 202 and the calendar 203 can advantageously be made. If time indicates a night hour (range of 1 am to 5 am for example, and/or as confirmed by the accelerometer and/or confirmed by a sensor adapted to assess lighting conditions, i.e. darkness), then the data presenting the highest priority in terms of display priority would be the current basal rate (or the blood glucose level if the patient is provided with a continuous blood glucose monitoring). Calendar events also can be leveraged. For example, if the current date corresponds to the birthday of the user then the likelihood of happiness is increased. In particular, the likelihood that the user will have an important meal is increased. So are associated boluses doses. To the opposite, if an anniversary of a sad family event is determined, then the state of the patient will imply a certain number of consequences regarding the user interactivity to be conducted (fewer reminders, less maintenance tasks if possible, etc). User interactivity and machine behavior can be defined by user-defined preferences or by machine learning or driven by rules retrieved from the network. The assessed state of the user or patient will indeed drive the interactivity model. The user profile 203 comprises data such as the age of the patient, user preferences (in terms of display, reminders, alerts, type and frequency of desired interaction), habits (typical agenda and schedules, date of anniversaries of family members,...) health statistics, personal rules, as well as sources of data in which to retrieve - in real-time or not - additional personal data (such as email or social network website account for example). For example, just taking into account the age of the patient leads to an effective user interaction. Above 60 years old, the system may introduce a bias in the pump preferences to increase the probability of switching to the zoom mode when certain criteria are met (automatic triggering information). These settings can be made manually (the user editing his permanent preferences) or can be set up automatically. Said display preferences also can comprise particular rules. For example, when the presence of certain persons are detected in the vicinity of the patient wearing the medical device, a particular display mode can be deactivated (for example a zoom mode) or switched off when handled by the doctor and no longer by the child. User preferences also can be edited. For example, the user can edit his own list of priority ranks (see figure 8), each information type being associated with a priority rank (bolus dose is associated with rank 1, previous bolus the day before is associated with rank 2, date and time is associated with rank 3 for example)

[0043] The figure 3 shows an electronic device such as an insulin pump provided with a display screen and a touch sensitive surface for triggering a zoom function. The figure 3 shows a particular embodiment, namely an insulin pump provided with a screen. The figure comprises a pump housing 300, a user interface 310 comprising

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command and navigation buttons, a screen 320, data 330 being displayed on the screen, a zoom cursor 340, a physical button 350.

[0044] According to this embodiment, the triggering information corresponds to an action of the user on the zoom cursor 340. Said cursor is made of touch sensitive surface which is separated from the screen 320 (according to other embodiments this input area can be part of a touch screen). The zoom cursor enables the user to minimize or maximize the display of reviews we selected display data. The optional physical button 350 can have the same role or function as the zoom cursor. It also can modulate or modify the effects caused by the zoom cursor (for example, multiplication or smoothening of the effect generated by the zoom cursor, transformation of the text into speech or audio signal, etc)

[0045] A particular embodiment of a disclosed system will now be described. In[r1] figure 3 is disclosed a medical infusion pump including a feature hereinafter called a "zoom badge". With this new feature, it is possible to change or switch back and forth between different pump displays (corresponding to different sizes of character fonts or symbols). Persons with diabetes presenting a constantly raised blood sugar level leads to retina damages (blood vessels of the retina of the eye are damaged). Old persons also have vision troubles. In order to adapt to these patients, data readability must be enhanced. According to the embodiment described in the figure 3, the size and type of the figures displayed can be increased upon the user selection and/or triggering of said "zoom badge". Alternatively of cumulatively, a negative view of the screen can be provided (the background color can be set to black and letters be set in white or vice-versa). Another possibility is to use specific color codes (for example basal rate would be in red, current glucose value would be in orange, other information would be displayed in gray scales). Yet another possibility would be to only display uniform colored rectangles, corresponding to ranges of values. For example, a blood glucose value between 80 and 120 would correspond to a green rectangle, while a range between 60 and 80 would result in a light pink color rectangle and a range between 120 and 250 would appear in dark red (above 250 a black rectangle would appear). Such color code display is adapted to children. An image comprising a vertical scale and a cursor also can be used for this audience. Extra-large screens now provided with pumps allow such features. Video capabilities also offer such similar developments (images of moods, animated characters, virtual animal reflecting the current state, etc). In the present embodiment, a separate triggering surface has been preferred. Said surface is touch-sensitive and comprises several thresholds corresponding to several discrete zoom states (but said magnification or minimization of course can occur continuously). It has been chosen to place this triggering surface below the main display, for a better ergonomics and a faster activation. The zoom badge uses the well-known symbol "+" and the unambiguous symbol in the form of a magnifying glass. Users can use this triggering surface in bad lighting conditions (very bright sunlight or artificial light, during the night, etc), during hypoglycemia or hyperglycemia events, when they have forgotten their glasses, when they are tired, when they want to show the display to other persons, etc. In order to change the mode of display rapidly and in an uncomplicated way (from normal to increased size back and forth for example), the user simply displaces the finger on the triggering surface and chooses the appropriate zoom scale. Of course repeated action or sequences of actions can trigger other interface behaviors (such as combined sub selection of data and zoom functionality). According to an embodiment, the "zoom badge" is automatically activated when touching the surface, the size of letters and figure is moved up (or down). In addition, as long as the function is active, the symbol of the magnifying glass symbol lights on in order to state that the zoom function is active. The lightening of the symbol can be obtained by means of a diode or an OLED screen for example. The zoom function remains as long as the user touches the triggering screen. When the user ceases to touch or releases the finger, the display returns to its initial (normal) state.

[0046] A special attention was allocated to this zoom function and associated user interface: the active switching is combined with the determination or selection of the most important medically information to be displayed.

[0047] In a first embodiment, all non-important information is ignored in the zoom process, i.e. only important information is magnified. For example, date and time do not appear during the magnification process, which only displays the blood glucose value. The determination of "important" versus "non-important" can be obtained by application of a certain threshold in a data model, possibly context-dependent or said distinction can be predefined.

[0048] In a second embodiment, all previously displayed information continue to be displayed but the geometrical proportions are rearranged (size and shape of the data being displayed will vary according to each associated priority level). For example, the date and time are still displayed, but much smaller while the saved space is used to increase the display size of the blood glucose value.

[0049] A list by decreasing priority is proposed: amounts of injected insulin, critical security indications (such as error or maintenance messages), steps for a particular function (in a message like "disconnect the pump and replace reservoir", the word "disconnect" is magnified and others text strings are diminished in size or completely hidden if the user presses again the zoom button).

[0050] In other words, sub priorities can be defined to reach multiple levels of communication. In addition to the user friendliness of the interface, the security aspect is essential. Therefore, an enhanced communication with the patient leads to a better security. Misunderstandings or misreading's can be avoided by the disclosed methods

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and systems.

[0051] The figure 4 shows an example of the data displayed on a display screen which is part of an insulin pump. The figure 4 shows an example of displayed data. The figure comprises time information 400, (temporary) flight mode information 410 (no active communication channels), battery information 420, date or calendar information 320, numerical value 440, unit value 450, and type of information 460. This of course is just one screenshot example, illustrating the type of data being displayed on an insulin pump.

[0052] In one embodiment, disclosed methods handle the selection of a subset of data from a displayed dataset, i.e. from data which are already displayed. This corresponds to the real-life scenario, wherein a user benefits from an enlargement of actually displayed data. In another embodiment, the disclosed method handles the selection of a subset of data from a dataset, which dataset can include displayed and non-displayed data (broader scope). For example, if the blood glucose is low according to a certain threshold, then the speed of the decrease in values is also of interest and may be also displayed. In this view, disclosed methods provide even more than a contextual zoom functionality (triggered automatically and/or partly on-demand and based on the intelligent selection of existing parts of the display): said methods enable and provide a further level of logic by adapting the display of data a step further (i.e. by including or taking into account a certain anticipation resulting from the assessment of a global situation - and not only from a limited point of view).

[0053] The figure 5 shows examples of possible selections of the subset of data and the further modifications brought to the original displayed dataset. The figure 5 shows different illustrative screenshots, corresponding to different embodiments. The situation (a) corresponds to the initial display. Upon the reception of triggering information, the initial display is replaced by the screen illustrated in situation (b). In this view, information related to that date and time, flight mode and battery information have been skipped or wiped out or erased or hidden or masked. Simultaneously, the information related to the basal rate has been enlarged, i.e. is displayed in a larger format. Alternatively, the situation (c) illustrates a further modification: the text has been shortened by the use of an acronym. In the situation (d), the only information left is the figure of the basal rate. The patient knows what is implicit. In other words, the patient does not need to be distracted by other information than the very important figures. It is believed that diabetic patients even know how to discriminate between a basal rate and a bolus dose without any further indication (these values having very different ranges). A better efficiency is then reached when the variable data is immediately and directly displayed. In this perspective further details can be displayed upon reception of triggering information. In a preferred embodiment, the screen (d) is first presented to the user and other information as illustrated in (a), (b) and (c) are displayed only when requested.

[0054] The figure 6 shows other modes of display for enhanced readability. The situation (a) corresponds to the initial display. The situation (b) presents both iconic and textual communication. Many graphical forms can indeed be used: symbols, icons, images, videos, textual forms. In other to optimize the space or format of the screen, different pavement techniques can be used. The situation (c) corresponds to the visual effect of a negative image. A positive image is a normal image. A negative image is a total inversion of a positive image, in which light areas appear dark and vice versa. A negative color image is additionally color reversed, with red areas appearing cyan, greens appearing magenta and blues appearing yellow. This transformation may lead to enhanced readability. The situation (d) corresponds to a video effect such as scrolling. In this mode, the surface of the screen may be optimized to the display.

[0055] The figure 7 shows an example of a full-screen optimization. The figure 7 shows a sequence of screenshots, each screenshot corresponding to the maximum use of the available screen surface for the display of a number comprising several figures. At time t1, the first digit "1" Is displayed using the entire screen. At time t2, the sign "," or "." is displayed using the entire screen. At time t3, the second digit "2" Is displayed using the entire screen. At time t4, a graphical symbol "*" Is displayed, meaning that the end or the beginning of the sequence has been reached. This example presents many variants: letters and digits can be rotated, different fonts can be used, time intervals may vary (the first digit may appear during 2 seconds while the second digit appears during a shorter time because being less important, for example).

[0056] As a summary regarding display modes, the display of information can be:

- temporary (the zoom occurs during a certain predefined number of seconds);
- intermittent (back and forth);
- permanent (see later);
- "hybrid" (a number such as '123' in blood glucose level is displayed as a succession of '1' then '2' then '3' the letters covering the full available screen and a begin/stop information is provided (either the full '123' value either a symbol '*' or another convention)

[0057] The figure 8 shows examples of a data priority scheme. As discussed, said scheme can comprise a knowledge base of facts, a set of rules, priority ranks, or other components. The priority scheme can be static (i.e. the components do not evolve over time) but it may also be dynamic (priority ranks evolve over time, and/or are responsive to local events and/or regulation rules and/or user profiles or preferences and/or contextual data

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and/or environmental data and/or ambient data).

[0058] Many patterns are possible for the implementation of the data priority scheme. In figure 8a, each type of information (corresponding to different numerical values) is associated with an absolute priority rank (or ranking). For example, information related to a bolus dose is allocated to a level 1 while date and time information is allocated with an inferior priority of 4. Optionally, an icon or a symbol is associated with each type of information (for further use on display operations). Optionally again, each type of information can be associated with a different triggering option (user-defined or automatically driven by sensors). For example, the basal rate can be triggered by the user but cannot be triggered by one or more sensors. It is conceivable to limit the actions of sensors to the display of the glycemic state (blood glucose value) only. As indicated on the figure, numerous variants exist. More subtle priority levels can be defined, conflicts can be anticipated, rules can be downloaded or retrieved in order to solve conflicts, etc. The figure 8b shows another embodiment, providing details and focus on the context of the display of data. Depending on the moments of the day (or the night), certain information may become more relevant. During the night, if a sensor detects a movement signaling that the patient is waking up, the basal rate and or the blood glucose level are important information to display first. By contrast, cartridge state may not be as important. This assessment can be predefined, i.e. be defined according to statistics. But the assessment also can be dynamically defined. For example, if the cartridge is almost empty, the priority is modified and the cartridge state becomes the most important data to be displayed. User acknowledgement may be required in order to return to the predefined state. If sensors, together with the time information, detect that the user is likely to have lunch (movements are detected after a quiet period associated to a probability of the patient being working, thus indicating that the patient is moving to the cafeteria), the top priority data can be switched to the bolus menu. While being back at work, the main focus of the user would be information related to maintenance events. During the night, blood glucose value is likely to be considered as top priority information. In 2 seconds, with almost closed and tired eyes, one should be able to get the information directly (any other information, except the time maybe, may not be interesting for the user)

[0059] Presently disclosed methods and systems establish or leverage a data priority scheme but also enable to anticipate for further menu selection and user actions. The display of data can be optimized but also the entire user interaction model.

[0060] While disclosed methods and systems enable a "proactive" user interaction, the latter does not become unpredictable (because a return to the normal state and behavior of the medical device remains always possible). In reality, the medical device would try to be the most useful as possible but, when triggered, it would return into its "passive" state. An alternative consists in displaying, as a "second chance" mode, a second subset of data to the user (or according to an alternative manner). Successive user commands can enable such "switches" (for example one first press on a button results in a first display mode, a second press results in another mode, and at the third press the system gives up and returns to its initial state). In this view, some opportunities are provided to the machine to show its "intelligence", but after a (limited) number of trials, the machine returns in passive or obeisance mode.

[0061] The figure 9 shows examples of different embodiments and architectural choices, with different triggering information interfaces and/or different display devices and/or different communication modes. The figure 9a shows an insulin pump with both a zoom cursor 910 and a physical triggering button 911. The figure 9b shows an insulin pump provided with a zoom cursor 910 only. The figure 9c shows an insulin pump provided with a physical triggering button 911 only. The figure 9d shows an insulin pump without an embedded screen but provided with a projector 921. Said projector beams an image on a wall or on another surface 940. This projector is a handheld projector (also known as a pocket projector or mobile projector or pico-projector). Handheld projectors involve miniaturized hardware and software that can project digital images onto any nearby viewing surface, such as a wall. Such a system is compacted into one chip and presents the ability to project a clear image, regardless of the physical characteristics of the viewing surface. The projector can be integrated with the insulin pump or embodied as a separate device communicating with the pump. The figure 9d shows another embodiment, in which the pump 930 comprises drug injection means, is connected to the infusion set 938 by the tubing 931 and does not comprise an embedded display. In this case, the pump communicates with display means 940 present in the vicinity of the user or pump by a communication channel 933 (see a list of display devices 150 in figure 1).

[0062] The figure 10 shows an example of a real life situation. The user 1000 is wearing a medical device 1020 and sensor measuring his heart rate 1041. Those devices and sensors communicate wirelessly with other devices. The environment sensor 1043 is present in the environment and provides geographical location data. The user is first driving his car, in which the dashboard is provided with the projector 1031, communicating 1011 with the pump 1020 and/or the sensor 1041. The sensor 1041 detects a high heart rate superior to the predefined threshold of 130 pm, while at the same time the continuous glucose monitoring device attached to the body of the user determines a probability of an hypoglycemia event. By integrating the two values the life situation assessment logic determines that an alert should be raised. The display logic 210 or 1040 in turn determines that a projector is present in the car and available for data display. The display logic 210 triggers display of the value of the current measured value of blood glucose on the

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windscreen of the car (particular area for the display can be chosen, according to driving events, for example by avoiding acceleration moments and using possible stops of the car). The user being informed of his Physiological state (of which he was not currently conscious of) stops driving and goes for a snack in a cafeteria nearby. The user passes by a television present in the cafeteria. The sensor 1042 of the television 1010 in the cafeteria communicates with the pump 1020 and after authorization, authentication and privacy settings verification steps prompts A meal recommendation (carbs and bolus dose taking into account the hypoglycemia) to the user.

[0063] The figure 11 shows an example of a head-mounted display embodiment. Since the user is likely to wear his pump or medical device with him all the time, but according to some scenarii, certain medical devices such as micro-pumps will not be provided with screens. Display means may be integrated in head-mounted displays. A head-mounted display is a display device, worn on the head, which has a small display optic in front of one (monocular) or each eye (binocular). A typical head-mounted display has either one or two small displays with lenses and semi-transparent mirrors embedded in a helmet, eye-glasses (also known as data glasses) or visor. The display units are miniaturized and may include CRT, LCDs, or OLED. Head-mounted displays differ in whether they can display just a computer generated image, show live images from the real world or a combination of both. Some head-mounted displays allow a computer generated image to be superimposed on a real-world view. This is sometimes referred to as augmented reality or mixed reality. Combining real-world view with computer generated image can be done by projecting the computer generated image through a partially reflective mirror and viewing the real world directly. This method is often called "Optical See-Through". Combining real-world view with computer generated image can also be done electronically by accepting video from a camera and mixing it electronically with computer generated image. This method is often called "Video See-Through".

[0064] In such devices, the zoom functionality presents some specificity. The attention of the user shall be properly managed to avoid unnecessary distractions. Appropriate areas in the field of vision have to be determined. The balance and compromises to be made correspond to the present invention which mechanisms allow for a balanced compromise, ponderation or selection of data to be displayed (with respect to substance), and the visual effect such as placement, surface, area, still or animated modes (with respect to the form).

[0065] The figure 12 shows an example of a retinal display embodiment. The user is wearing a virtual retinal display 1200, also known as a retinal scan display or retinal projector. This is a display technology that draws a raster display (like a television) directly onto the retina of the eye. The use of a coherent source (such as a laser diode) allows the system to draw a diffraction limited spot on the retina. The light beam is intensity modulated to match the intensity of the image being rendered. The user sees what appears to be a conventional display floating in space in front of them. Virtual retinal display system also can show an image in each eye with a very little angle difference for simulating three-dimensional scenes. Another important advantage is privacy since only the intended user is able to see the image displayed.

[0066] The solved technical problem and solution corresponds to an optimization. A compromise is determined among a set of factors. Heterogeneous data provided by heterogeneous sensors are integrated to provide an assessment of the mood or physiological state of the user and data are then being displayed in an appropriate manner with respect to said state. The appropriate manner of displaying depends on the presence and accessibility of heterogeneous Display means being present in the vicinity of the user (support), depends on the data priority scheme allocated to the considered user (form and substance).

[0067] The present disclosure encompasses macro sensors (millimetric to centimetric scales), as well as micro sensors or even nano-sensors. The more miniaturized the more data. Nano sensors, for example, could let people monitor the level of a given drug in their blood in real-time (the monitoring can be continuous but it also can be real-time).

[0068] A presentation of information defined solely by the content of the information is not patentable. Here, claims are not directed to the presentation of the information *per se*. A claim directed to a device displaying data is not unpatentable even if it involves non-technical features relating to the presentation of information. Provided examples of methods and systems do use the presentation of information, but this aspect *per se* is peripheral. Associated effects or advantages stemming from the very presentation of information are leveraged in (or by) certain specific contexts. The present disclosure triggers and leverages such inherent (and non-technical) effects. The automatic visual display of the conditions prevailing or desirable in an apparatus or system is a technical problem. Provided examples define a technical system combining these non-technical display effects with technical input/triggering interfaces and (technical) data model, i.e. logic or decision based on data priority schemes and measures provided by sensors, technical means enabling the displaying information.

[0069] The data being handled in the present information are medical data. These data are regulated when it comes to advise the user or when said data lead the patient or user to a therapeutic action, which is presently not the case (raw information, in the sense of measurements, are provided and not recommendations for action).

[0070] Disclosed is a medical system, comprising a display and wherein in response to the reception of triggering information, a subset of data is selected from a displayed dataset according to a data priority scheme and wherein the displayed dataset is replaced by the dis-

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play of the selected subset of data. The display of the selected subset of data uses a variety of rendering options. The triggering information is provided by the user of provided by one or more sensors. The data priority scheme is predefined or computed. It is static or dynamic. The data priority scheme can comprise a threshold which is applied for the selection or determination of the subset of data. Examples of priorities for diabetes care are provided. A wide range of display means can be used and combined.

[0071] In yet more detail, the present invention encompasses the following items:

1. A method of controlling the display of a dataset, the method comprising the steps of:

   in response to the reception of triggering information, selecting a subset of data from a displayed dataset according to a data priority scheme and replacing the displayed dataset by the display of said selected subset of data.

2. The method of claim 1, wherein the display of the selected subset of data uses one or more visual rendering effects such as magnification, enlargement, zooming, minification, minimization, resizing, masking, scrolling, blinking, morphing, distorting, greyscaling, discretizing and/or coloring.

3. The method of any preceding claim, wherein the triggering information corresponds to user-defined information, such as an information provided by a touch sensitive surface or by a physical button or by a portion of a capacitive or of a resistive touchscreen, or by a motion sensing input sensor adapted to interpret gestures, or by a sensor responsive to a voice or an audio signal such as a voice recognition device, or by an eye-tracking sensor adapted to interpret human eye movements.

4. The method of claim 1 or 2, wherein the triggering information is provided by a sensor, which sensor is selected from a group, or is a combination thereof, comprising: a sensor adapted to perform human face detection, a sensor adapted to evaluate the distance to an human eye, a sensor adapted to detect or analyze breath or smell, a sensor adapted to interpret acceleration data or movements, a sensor adapted to monitor environmental or contextual conditions such as lighting conditions, a sensor adapted do determine an ambient audio level, a sensor adapted to determine a geographic location such as a GPS device, an electroencephalography EEG sensor, an electrocardiography ECG sensor, an electromyography EMG sensor, a sensor adapted do determine a body temperature, a sensor adapted to monitor continuously or discretely a user body parameter such as a blood glucose level or a heartbeat rate or a blood cholesterol level or a blood alcohol level or a blood analyte level.

5. The method of any preceding claim, wherein the data priority scheme is predefined or computed and/or static or dynamic.

6. The method of any preceding claim, wherein the data priority scheme comprises an association of one or more priority ranks with one or more data of the dataset.

7. The method of any preceding claim, wherein the data priority scheme further comprises at least one priority threshold applied for the determination of the subset of data.

8. The method of any preceding claim, wherein said association and/or threshold are locally predefined or remotely retrieved.

9. The method of any preceding claim, wherein the display occurs on one or more display devices selected from a group of display devices, or a combination thereof, said group of display devices comprising: a projector, a television, a computer, a telephone, a car windscreen with projector, a headed-mounted display device such as video glasses or such as a retinal projector.

10. The method of any preceding claim, wherein the dataset is associated with diabetes data, such as blood glucose data, bolus dose, bolus type, basal rate, temporary basal rate, calibration reminder, occlusion probability or event, leakage probability or event, hypoglycemia probability or event, hyperglycemia probability or event, ketosis or ketoacidosis probability or event, maintenance event or reminder such as cartridge or reservoir replacement or battery replacement.

11. The method of any preceding claim, wherein one or more steps of the method are implemented in a medical infusion system, comprising one or more of the following devices: drug pump such as an insulin pump, continuous blood analyte monitoring device, multi-injection device such as a drug pen device.

12. The method of claim 11, wherein the insulin pump of the medical infusion system further comprises a processor adapted to select the subset of data or comprises communication means adapted to retrieve the selection of the subset of data from the network.

13. A system comprising means adapted to carry out the steps of the method according to any one of claims 1 to 12.

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14. A computer program comprising instructions for carrying out the steps of the method according to any one of claims 1 to 12 when said computer program is executed on a suitable computer device.

15. A computer readable medium having encoded thereon a computer program according to claim 14.

[0072] The invention can take form of an entirely hardware embodiment, an entirely software embodiment or an embodiment containing both hardware and software elements. In a preferred embodiment, the invention is implemented in software, which includes but is not limited to firmware, resident software, microcode, etc. Furthermore, the invention can take the form of a computer program product accessible from a computer-usable or computer-readable medium providing program code for use by or in connection with a computer or any instruction execution system. For the purposes of this description, a computer-usable or computer-readable can be any apparatus that can contain, store, communicate, propagate, or transport the program for use by or in connection with the instruction execution system, apparatus, or device.

Claims

1. A medical system, comprising a display and wherein in response to the reception of triggering information, a subset of data is selected from a displayed dataset according to a data priority scheme and wherein the displayed dataset is replaced by the display of the selected subset of data.

2. The medical system of claim 1, wherein the display of the selected subset of data uses one or more visual rendering effects such as magnification, enlargement, zooming, minification, minimization, resizing, masking, scrolling, blinking, morphing, distorting, greyscaling, discretizing and/or coloring.

3. The medical system of any preceding claim, further comprising a user-triggered device, which is selected from a group, or is a combination thereof, comprising: a touch sensitive surface, a physical button, a portion of a capacitive or of a resistive touchscreen, a motion sensing input sensor adapted to interpret gestures, a sensor responsive to a voice or an audio signal such as a voice recognition device, an eye-tracking sensor adapted to interpret human eye movements.

4. The medical system of claim 1 or 2, wherein the triggering information is automatically provided by a sensor, which sensor is selected from a group, or is a combination thereof, comprising: a sensor adapted to perform human face detection, a sensor adapted to evaluate the distance to an human eye, a sensor adapted to detect or analyze breath or smell, a sensor adapted to interpret acceleration data or movements, a sensor adapted to monitor environmental or contextual conditions such as lighting conditions, a sensor adapted do determine an ambient audio level, a sensor adapted to determine a geographic location such as a GPS device, an electroencephalography EEG sensor, an electrocardiography ECG sensor, an electromyography EMG sensor, a sensor adapted do determine a body temperature, a sensor adapted to monitor continuously or discretely a user body parameter such as a blood glucose level or a heartbeat rate or a blood cholesterol level or a blood alcohol level or a blood analyte level.

5. The medical system of any preceding claim, wherein the data priority scheme is predefined or computed and/or static or dynamic.

6. The medical system of any preceding claim, wherein the data priority scheme comprises an association of one or more priority ranks with one or more data of the dataset.

7. The medical system of any preceding claim, wherein the data priority scheme further comprises at least one priority threshold applied for the determination of the subset of data.

8. The medical system of any preceding claim, wherein said association and/or threshold are locally predefined or remotely retrieved.

9. The medical system of any preceding claim, further comprising one or more display devices selected from a group of display devices, or a combination thereof, said group of display devices comprising: a projector, a television, a computer, a telephone, a car windscreen with projector, a headed-mounted display device such as video glasses or such as a retinal projector.

10. The medical system of any preceding claim, wherein the dataset is associated with diabetes data, such as blood glucose data, bolus dose, bolus type, basal rate, temporary basal rate, calibration reminder, occlusion probability or event, leakage probability or event, hypoglycemia probability or event, hyperglycemia probability or event, ketosis or ketoacidosis probability or event, maintenance event or reminder such as cartridge or reservoir replacement or battery replacement.

11. The medical system of any preceding claim, wherein said medical system is a medical infusion system, comprising one or more of the following devices: drug pump such as an insulin pump, continuous

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blood analyte monitoring device, multi-injection device such as a drug pen device.

12. The medical infusion system of claim 11, wherein the insulin pump further comprises a processor adapted to select the subset of data or comprises communication means adapted to retrieve the selection of the subset of data from the network.

13. A method comprising steps corresponding to any one of the system claims 1 to 12.

14. A computer program comprising instructions for carrying out the steps of the method of claim 13 when said computer program is executed on a suitable computer device.

15. A computer readable medium having encoded thereon a computer program according to claim 14.

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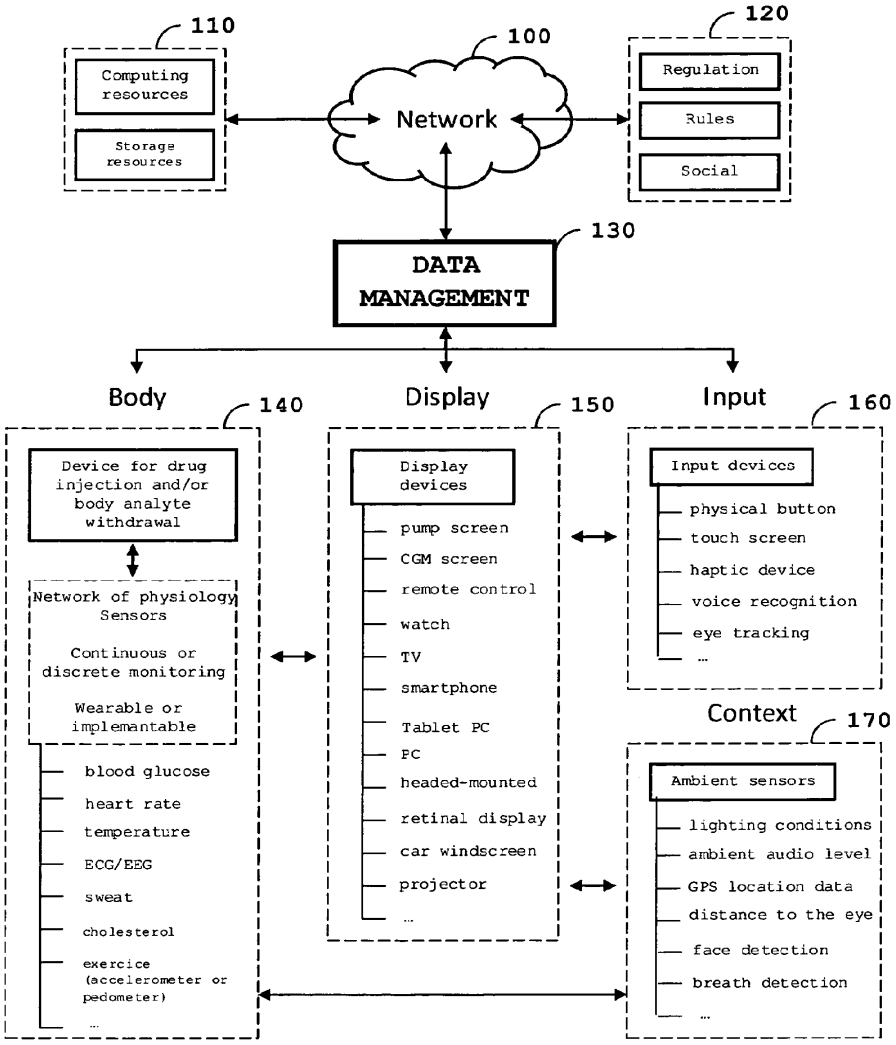


Fig.1

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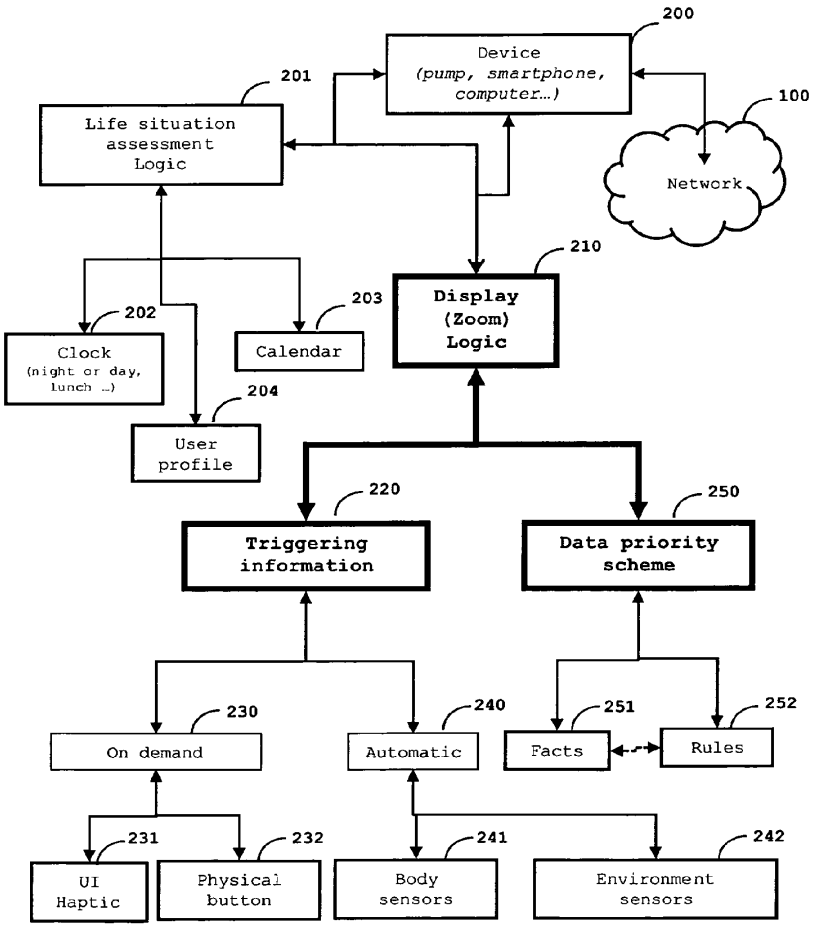


Fig.2

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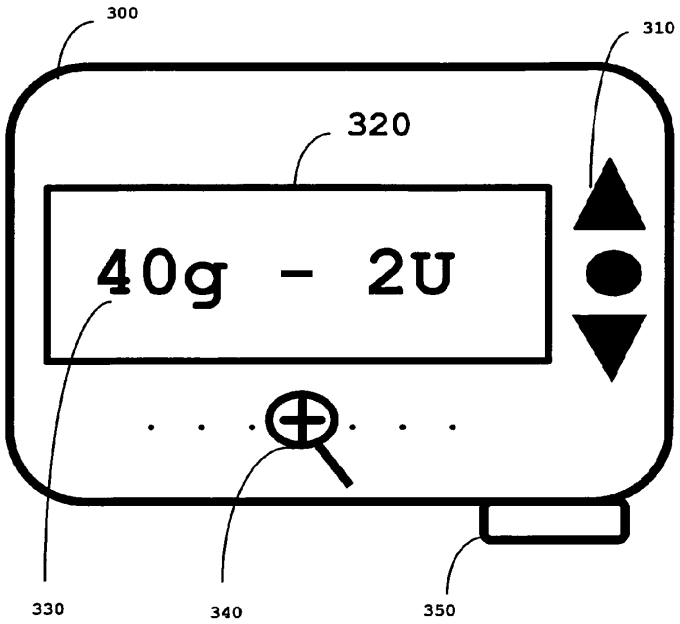


Fig.3

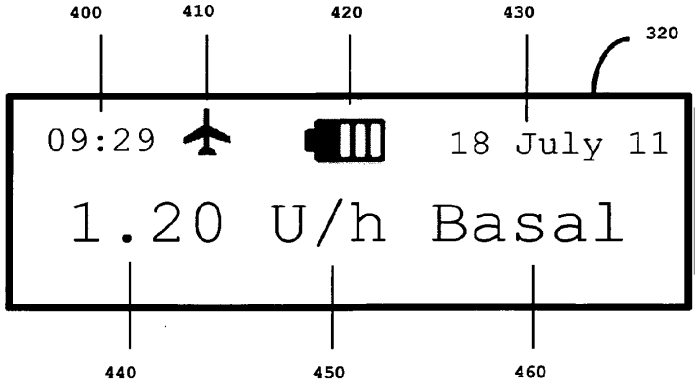


Fig.4

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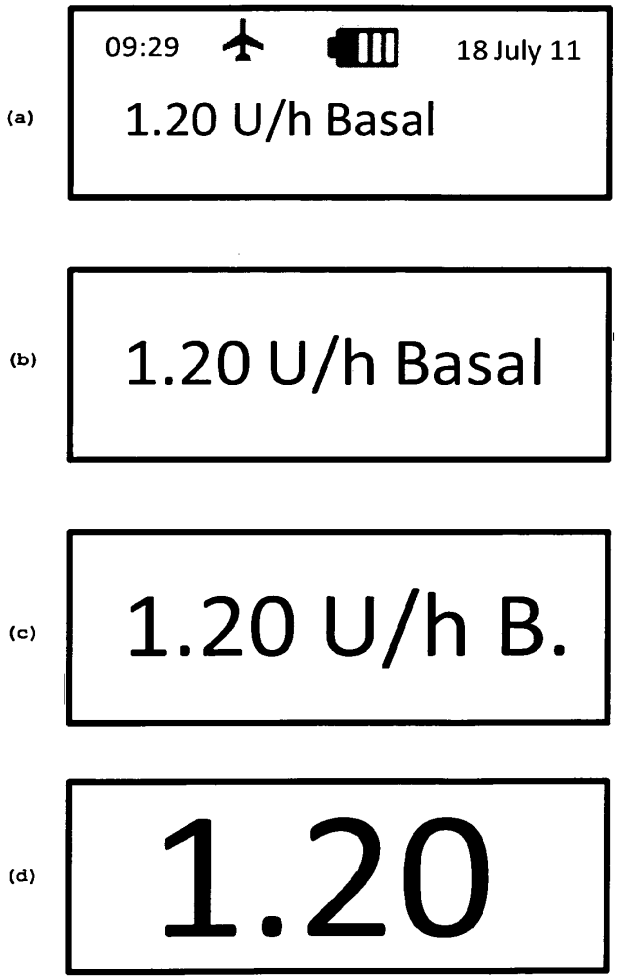
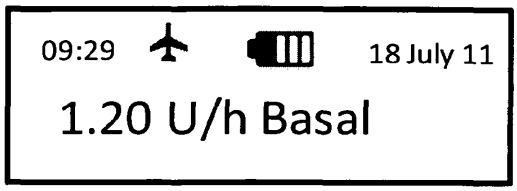


Fig.5

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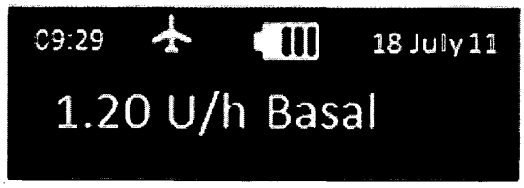
(a)



(b)



(c)



(d)



Fig.6

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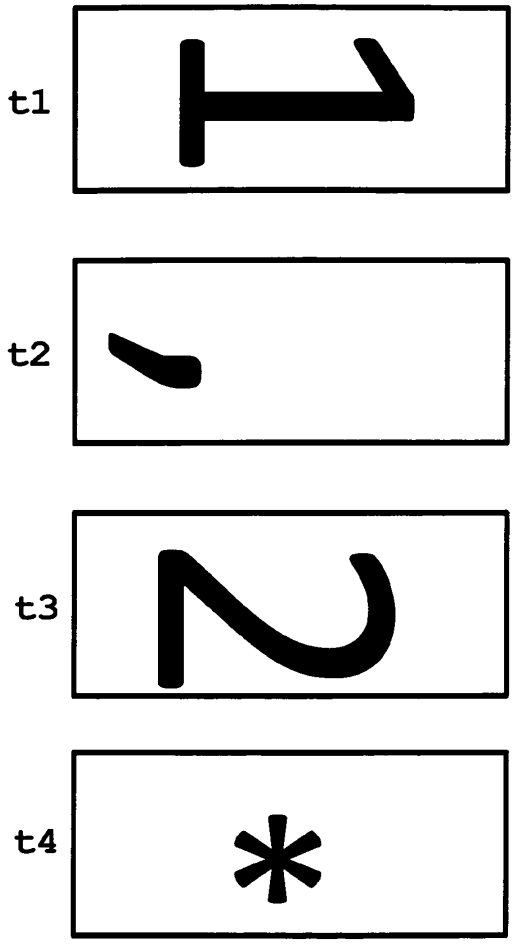


Fig.7

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Data entry	Priority rank	Auto-matic	User defined	...	Icon
Bolus dose	1	Y	Y	...	...
Basal rate	1	N	Y	...	
...	...	...	...	...	...
Date and time	4	N	4	...	...

Fig.8a

	Priority rank				
Information	Day	Night	Work	...	Lunch
Basal	1	1	3	...	3
Basal Temporary Rate	1	1	4	...	3
Bolus Multiwave	1	4	4	...	2
Bolus Standard	1	4	4	...	1
Cartridge	2	2	4	...	4
Lag	2	4	4	...	2
Leakage	2	4	4	...	4
Maintenance	2	2	4	...	4
Mode (flight, ...)	4	4	4	...	4
Occlusion	1	1	1	...	1
Pairing	4	4	4	...	4
Pump memory	3	4	4	...	4
Pump timer	3	4	4	...	4
Quick Bolus	1	4	4	...	1
Time	2	4	4	...	4
Warning	1	1	1	...	3

Fig.8b

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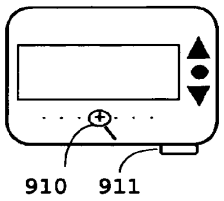


Fig.9a

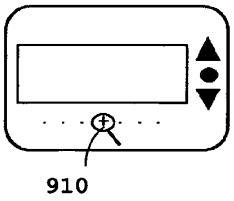


Fig.9b

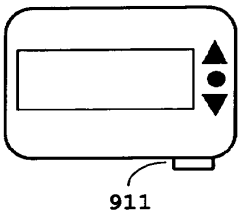


Fig.9c

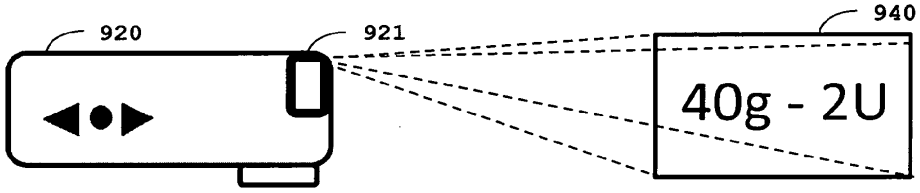


Fig.9d

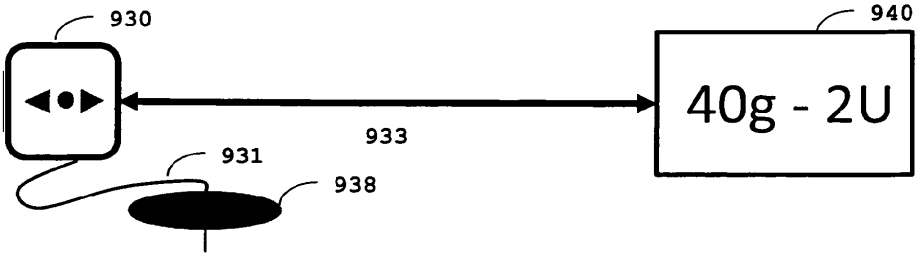


Fig.9e

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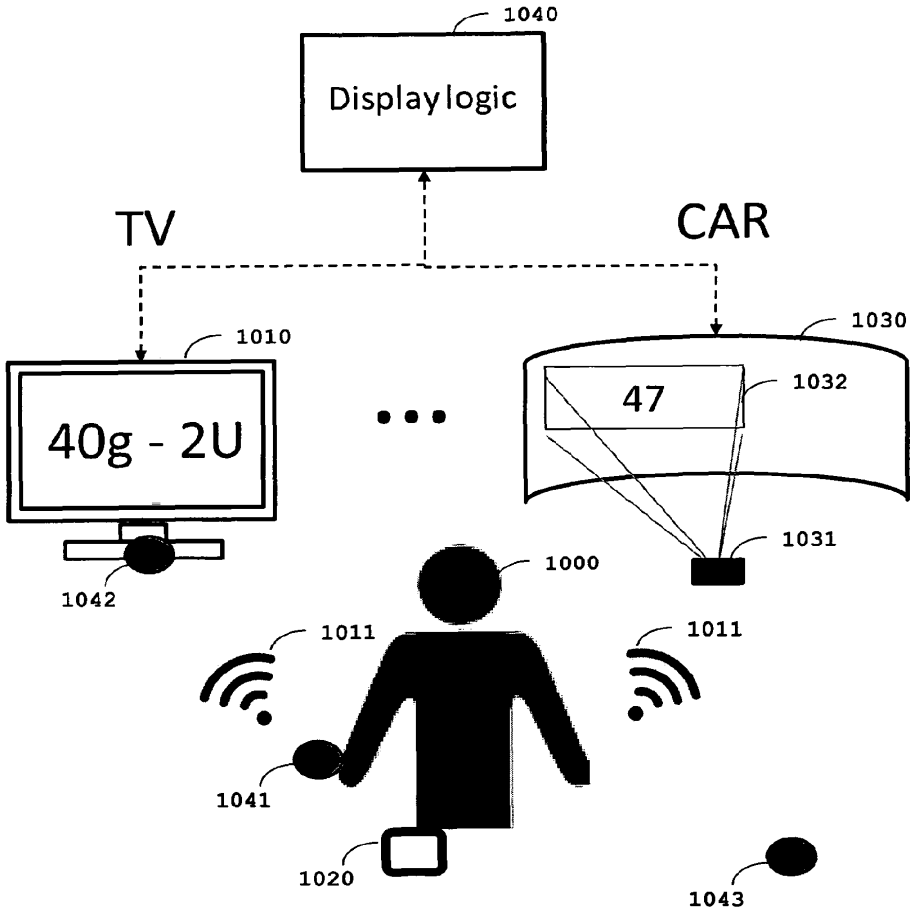


Fig.10

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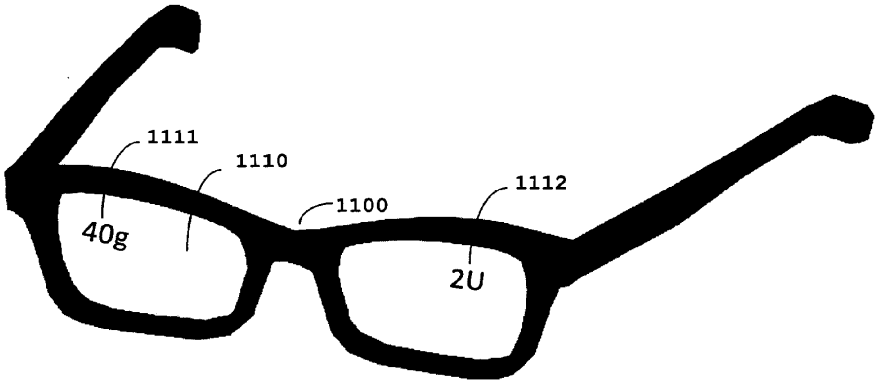


Fig.11

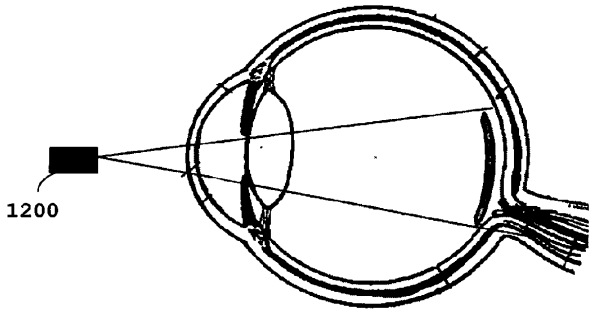


Fig.12

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EUROPEAN SEARCH REPORT

Application Number
EP 11 00 6203

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 2 284 675 A2 (LG ELECTRONICS INC [KR]) 16 February 2011 (2011-02-16) * abstract; figures 1-8 * -----	1-15	INV. G06F19/00 G06F3/048

TECHNICAL FIELDS SEARCHED (IPC)

G06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	30 November 2011	Swarén, Peter

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 11 00 6203

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2284675 A2	16-02-2011	EP 2284675 A2	16-02-2011
		KR 20110016337 A	17-02-2011
		US 2011037714 A1	17-02-2011

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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Patent documents cited in the description

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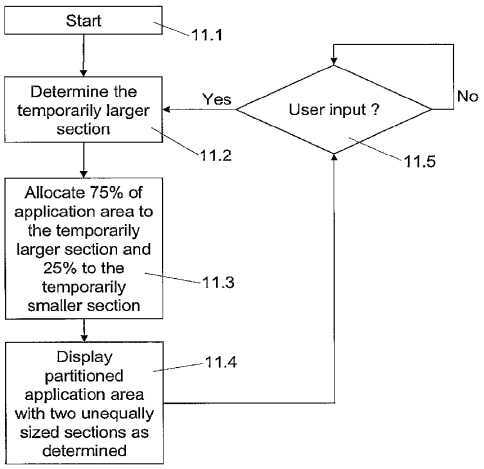
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(54) Title: MOBILE COMMUNICATIONS TERMINAL HAVING AN IMPROVED USER INTERFACE AND METHOD THEREFOR



(57) Abstract: A mobile communication terminal having a display with an application area thereon. The application area is partitioned into at least two unequally sized sections. The size of the application area allocated to the respective application area sections is dynamically controlled in response to user input.

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MOBILE COMMUNICATIONS TERMINAL HAVING AN IMPROVED USER INTERFACE AND METHOD THEREFOR

[0001] The present invention relates to mobile communication terminals with a graphical user interface and to a method of operating a user interface.

BACKGROUND ART

[0002] Mobile communication terminals, e.g. mobile phones, personal digital assistants (PDA) or the like have developed into computer terminals that offer almost the same functionality as a computer workstation or PC. These mobile terminals include office applications, internet browsers and game platforms, etc.

[0003] Many of the presently most advanced mobile communication terminals are operated with a Graphical User Interface (GUI) that resembles the GUIs used in workstations and PCs. However, mobile communication terminals generally lack a pointer device such as a mouse and have inherently a significantly smaller available display area than computer workstations and PCs.

[0004] Prior art GUIs for mobile communication terminals such as the Symbian Series 60 or the Windows Mobile 2003 Software for Smartphone® therefore, display only one window at a time, and the single window will contain significantly less information than a comparable window in a GUI for a PC or workstation. In the above-mentioned GUIs for mobile communication terminals a contact or phonebook list in a standard configuration shows a list of names without further detail. The entries in the list can be selectively highlighted and when a highlighted entry is selected a new window with the details of

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corresponding entry is displayed. The user has to close the window containing the detailed contact information in order to return to the list.

[0005] Contact lists or phonebooks in a PC or workstation GUI's will in comparable situations be able to display a window with a list of entries in one area of the window and the details of the presently highlighted entry in another area of the window. This way of presenting the information will give the user a better overview and facilitate navigation between entries in the phone or address book. The display size of a mobile communication terminal is, however, insufficient for implementing the PC or workstation type GUI thereon.

DISCLOSURE OF THE INVENTION

[0006] The present invention provides a mobile communication terminal comprising a user interface including a display component and an input component, a processor being configured to control operation of the terminal including being configured to receive input from a user through the input component, and to run an application on the terminal, the processor also being configured to show a partitioned application area with two or more application area sections on the display component when an application is running on the terminal, the processor further being configured to at least temporarily define an initial one of the application area sections as a larger application area section as shown within the partitioned application area, and simultaneously at least temporarily define a complementary one of the application area sections as a smaller application area section as shown within the partitioned application area, the processor moreover

being configured to at least temporarily redefine the initial one of the application area sections as a smaller application area section as shown within the partitioned application area, and simultaneously at least temporarily redefine the complementary one of the application area sections as a larger application area section as shown within the partitioned application area in response to user input, and the processor being configured to allocate a ratio of respective areas between the larger application area section and the smaller application area section within the partitioned application area.

[0007] The present invention provides further a method of operating a user interface of a mobile communication terminal having a display component and an input component, the method comprising the steps of running an application, showing a partitioned application area with two or more application area sections on the display component, temporarily defining an initial one of the application area sections as a larger application area section as shown within the partitioned application area; and simultaneously at least temporarily defining a complementary one of the application area sections as a smaller application area section as shown within the partitioned area, temporarily redefining the initial one of the application area sections as a smaller application area section as shown within the partitioned application area, and simultaneously at least temporarily redefining the complementary one of the application are sections as a larger application area section as shown within the partitioned application area in response to user input, and allocating a ratio of respective areas between the larger application area section and the smaller

application area section within the partitioned application area.

[0008] The present invention also provides a computer-readable medium containing instructions for controlling a mobile communication terminal with a display component and an input component to show a partitioned application area with two or more application area sections on the display component when an application is running, temporarily define an initial one of the application area sections as a larger application area section as shown within the partitioned application area; and simultaneously at least temporarily define a complementary one of the application area sections as a smaller application area section as shown within the partitioned area, temporarily redefining the initial one of the application area sections as a smaller application area section as shown within the partitioned application area, and simultaneously at least temporarily redefining the complementary one of the application are sections as a larger application area section as shown within the partitioned application area in response to user input, and allocating a ratio of respective areas between the larger application area section and the smaller application area section within the partitioned application area.

[0009] With this terminal, method of operating a user interface and computer-readable medium the user has the overview that is normally only possible with a PC or workstation since both application area sections of the application area are visible at all times, whilst the space limitation of the display of the mobile terminal is overcome by dynamically allocating the area available for each of the application area sections.

BRIEF DESCRIPTION OF THE DRAWINGS

[00010] In the following detailed portion of the present description, the invention will be explained in more detail with reference to the exemplary embodiments shown in the drawings, in which:

[00011] Fig. 1a is a perspective front view of a mobile communication terminal according to a preferred embodiment of the invention;

[00012] Fig. 1b is another perspective view of the mobile communication terminal of Fig. 1a showing the front and top of the terminal;

[00013] Fig. 2 is a block diagram illustrating the hardware architecture of the mobile communication terminal of Fig. 1a;

[00014] Fig. 3 is a block diagram showing the software architecture of the mobile communication terminal of Fig. 1a;

[00015] Fig. 4 is a screenshot of the desktop of the mobile communication terminal of Fig. 1a;

[00016] Fig. 5 is a diagram illustrating areas of the display of the mobile communication terminal of Fig. 1a;

[00017] Fig. 6 is another screenshot of the mobile communication terminal of Fig. 1a;

[00018] Fig. 7 is a front view of a mobile communication terminal according to another preferred embodiment of the invention;

[00019] Fig. 8 is a diagram illustrating the areas of the display of the mobile communication terminal of Fig. 7;

[00020] Figs. 9 and 10 are screenshots of a messaging application for the mobile communication terminal of Fig. 7;

[00021] Fig. 11 is a flowchart illustrating a process for allocating display area to application area sections;

[00022] Figs. 12 and 13 are screenshots of a phonebook application for the mobile communication terminal of Fig. 7; and

[00023] Figs. 14 and 15 are screenshots of a variation of the phonebook application of Figs, 12 and 13.

DETAILED DESCRIPTION

[00024] In the following detailed description, a mobile communication terminal according to the invention in the form of a hand portable phone, preferably a cellular/mobile phone, will be described by the preferred embodiments. The term mobile communication terminal as used here includes all hand portable terminals provided with a form of wireless or wired connection to a network or other terminal. Another example of such a terminal could be a PDA with a Wi-Fi® capability.

[00025] Referring now to Figs. 1a and 1b a mobile phone 1 according to a preferred embodiment of the invention is disclosed. The mobile phone 1 has a housing, switch keys 2, a stylus operated touch screen 3, an on/off button 4, a clear key 5, an earpiece 8 (only the openings are shown), a hands free speaker 11 (only the openings are shown), a microphone 7 (only the opening is shown), a charger connector 9, and a Pop-Port™ 10. The phone 1 according to the preferred embodiment is adapted for communication via a cellular network, such as the GSM

900/1800 MHz network, but could just as well be adapted for use with a Code Division Multiple Access (CDMA) network, a 3G network, or a TCP/IP-based network (e.g. via WLAN, WIMAX or similar).

[00026] The mobile phone has a flat touch sensitive display 3 that is typically made of an LCD with optional back lighting, such as a TFT matrix capable of displaying color images.

[00027] A releasable rear cover (not shown) gives access to the rechargeable battery pack (not shown) in the back of the phone that supplies electrical power for the electronic components of the mobile phone.

[00028] Zoom and switch keys 2 are disposed on the right hand side of the display 3. The function of these keys depends on the application and the current view. When applicable, these keys make the zoom option available, and enable switching between different views in an application. When using the earpiece, pressing these keys is used to increase or decrease the volume level, respectively. The zoom and switch keys 2 are also used for playing games A four-way plus select key 6 is disposed to the left of the display and can be used for cursor movement, scrolling and selecting.

[00029] The mobile phone is additionally provided with call handling keys 12 (on-hook and off-hook), a swap key 13, a menu key 14, and a desktop key 15. The two call handling keys 12 are used for establishing a call or a conference call, terminating a call or rejecting an incoming call. The swap key 13 swaps between earpiece 8 and hands free speaker 11. The menu key 14 gives direct access to the menu, repeated presses moves between dialog

pages. The desktop key 15 opens the desk application, which is the main view for the terminal.

[00030] There are two ways to enter text (letters, numbers and special characters) for entering a telephone number, write a text message (SMS, MMS, e-mail), write a name (associated with the phone number), etc. The first way is by writing characters directly onto the touchscreen 3 using the stylus (not shown). Handwriting recognition transforms the handwriting into characters. The second way is by tapping the characters of an on-screen keyboard displayed on the touchscreen.

[00031] Fig. 2 illustrates, in block diagram form, the hardware architecture of a mobile phone 1 constructed in accordance with the present invention. A processor 18 controls the communication with the cellular network via the transmitter/receiver circuit 19 and an internal antenna 20. A microphone 7 transforms the user's speech into analogue signals, the analogue signals formed thereby are A/D converted in an A/D converter (not shown) before the speech is encoded in a digital signal processing unit 14 (DSP). The encoded speech signal is transferred to the processor 18, which e.g. supports the GSM terminal software. The processor 18 also forms the interface to the peripheral units of the apparatus, including a RAM memory 17a and a Flash ROM memory 17b, a SIM card 16, the touchscreen 3, the, the Pop-Port™ 10 and the keys 2, 4-6, 12-15 (as well as data, power supply, etc.). The digital signal-processing unit 14 speech-decodes the signal, which is transferred from the processor 18 to the earpiece 8 or the hands free speaker 11 via a D/A converter (not shown).

[00032] Referring now to Fig. 3 the software architecture of the mobile terminal includes:

[00033] the Operating System – Symbian OS v7.0s, which provides fundamental services to Series 90 Developer Platform 2.0;

[00034] the base Software – The common set of APIs and software found in all devices that use Series 90

[00035] Developer Platform 2.0;

[00036] the Lead software – APIs and software that extend Series 90 Developer Platform 2.0 in implementations on a device or range of devices;

[00037] applications – Functionality provided to the user, including:

[00038] communication applications such as telephone, messaging, and Internet browser with Macromedia Flash player;

[00039] media applications such as image viewer, camera, music player, voice recorder, RealPlayer, and FM radio;

[00040] personal information manager (PIM) with calendar, tasks, and contacts applications;

[00041] office support with word processor, sheet, and presentation viewer applications; and

[00042] the user Interface – one of a range of user interfaces, device screen orientation and resolution, keyboard, and so forth, implemented on devices that use developer platforms.

[00043] The main view of the terminal is the desktop. A screenshot of the page top is shown in Fig. 4. The desktop includes:

[00044] a title area 16 that displays the application name and group, name or other details about the status of the application. Access to menus is gained by tapping on the title area or by pressing the menu key 14;

[00045] a status indicator area 17 displaying status icons, indicating mail received, call in progress, silent profile, clock alarm, signal strength, battery level, data connection, etc.;

[00046] a toolbar 18, contains either shortcuts to often used applications or, in an application, a shortcut to useful tools;

[00047] a scroll bar 19, can be tapped or dragged to scroll the screen.

[00048] In most situations both the stylus and the four way key 6 can be used for navigation and the methods can be mixed. Applications are opened by double tapping an application icon 20 (first selecting the application icon and then tapping it again to open it), or by selecting an application icon with the four-way navigation key and then pressing the centre of the four-way navigation key.

[00049] When an application is open the screen changes to the format shown in Fig. 5 with an application area 22, a title area 23 above the application area, command buttons 24 next to the application area, an indicator area 21 with status icons on top and a clock area 25 below the command buttons 24. At the bottom of the touchscreen a toolbar (not shown) can be displayed. A screenshot of an

open application, in this case a text editing application is shown in Fig. 6.

[00050] According to another embodiment shown in Fig. 7, the mobile terminal uses a touchscreen 3 with a portrait layout. The mobile phone 1 according to the second embodiment has substantially the same components, construction, software and hardware architecture as the mobile phone according to the first embodiment. The main difference is in the layout of the touchscreen and the keys, so that the terminal can be used in the upright position with the display in portrait mode. Identical parts of the two embodiments have identical reference numerals. The microphone, charger connector and Pop-Port™ (none shown) are disposed at the bottom of the housing. The opening for the hands free speaker (not shown) is disposed on the right side of the housing.

[00051] The desktop of the second embodiment is substantially identical to the desktop shown for the first embodiment, except that the display is in portrait format.

[00052] When an application is open the screen changes to the format shown in Fig. 8 with an application area 22, a title area 23 above the application area, command buttons 24 above the title area, an indicator area 21 with status icons and a clock area 25 on top. In some applications, the application area is partitioned into two application area sections 22a and 22b. In some other applications (not shown) the application area is partitioned into three or more application area sections. At the bottom of the display a toolbar (not shown) can be displayed.

[00053] A screenshot of an open application, in this case a messaging application, is shown in Fig. 9. The messaging application can handle several types of messages such as SMS, MMS, e-mail, etc. In Fig. 9 the messages are e-mails. The command buttons 24 have the functions "New" (tapping this command button creates a new message), "Reply" (tapping this command button creates a reply message to the highlighted or open message), "Forward" (tapping this command button creates a forwarding message for the highlighted or open message), and "Delete" (tapping this command button deletes the highlighted or open message). The title area indicates the messaging inbox that contains 23 messages. The application area 22 is partitioned into application area section 22a and application area section 22b.

[00054] Application area section 22a displays the messages (the sender and at least a part of the message subject) in the inbox as a scrollable list of selectable items. The messages can be listed in accordance with user selectable criteria such as date of receipt. A scroll bar 28 allows the user to scroll through the list by tapping or dragging with the stylus. The four-way navigation key 6 can also be used to scroll through the list. When the inbox is opened, about three quarters of the application area 22 is allocated to application area section 22a which in this state is considered to be the temporarily larger application area section. This large section can therefore list a substantial number of messages, thus giving the user a good overview over the inbox.

[00055] One of the messages in the inbox is highlighted; default is the first massage on the list. The highlighting is obtained by a light blue box (indicating active focus), shown in grey scaling in the Figs. The

user can highlight a message by tapping on it with the stylus, or by jumping the highlighting from one message to the next on the list by using the four-way navigation key 6. Information concerning the highlighted message is shown in a temporarily smaller display area section 22b. Only about a quarter of the application area 22 is allocated to display area section 22b, and therefore only the message details and the subject can be shown. Thus, display area section 22b functions in this state as a preview window.

[00056] When the user selects the highlighted message in the inbox, about three quarters of the display area 22 is allocated to display area section 22b, which is then considered to be the temporarily larger application area section, as shown in Fig. 10. The message details, subject and a substantial part of the message text (or even the complete message text if it is short) can now the shown in display area section 22b. In this state display area section 22b functions as a message reading window. Some of the message details in application area section 22b can be selectable items. The highlighting in application area section 22a has changed form light blue to light olive green to indicate that active focus has changed to application area section 22) (light olive green is shown in grey scaling in the Figs). The sender, recipient and subject field in application section 22b is highlighted by a light blue box, shown in grey scaling in the Figs.

[00057] If the user returns to the inbox, by e.g. tapping on one of the messages in the inbox in application area section 22a, or by tapping/dragging the scrollbar 28, three quarters of the display area 22 is allocated to display area section 22a, which is then again the

temporarily larger application area section, and one quarter to display area 22b, as shown in Fig. 9. The user has now good overview over the inbox again. The user can also simply touch (or tap with the stylus) any of the display area sections to render it the temporarily larger application area section.

[00058] The message list operates in a similar manner for a list of sent, drafted or deleted messages.

[00059] Fig. 11 shows a flowchart illustrating the application area allocation process according to a preferred embodiment of the invention. When an application that uses the dynamic application area allocation process is started in step 11.1, the processor determines in step 11.2 which of the application area sections 22a, 22b is per default the temporarily larger application area section. In step 11.3 the processor allocates three quarters (75%) of the application area 22 to the application area section that has been determined to be the larger one, and one quarter (25%) to the other (complementary) application area section. In step 11.4 the processor displays the partitioned application area with the two unevenly sized sections as determined in step 11.2 and 11.3. In step 11.5 the processor checks for user input, and continues doing so until user input is received. When user input is received the processor determines in step 11.2 which of the two application area sections is to be the temporarily larger one, and the process of steps 11.3, 11.4 and 11.5 is repeated. The effect of step 11.2 depends on the type of user input. If e.g. a list in an application area section that is already the temporarily larger section is scrolled, there will not be any change in the allocation of application space. If, however, an item from a list in a temporarily

larger application area section is selected, the other application area section with details concerning the selected item will become the temporarily larger application area section. The ratio between the larger and the smaller application area sections can be fixed and predefined, or could be dependent on the content, type and amount of information to be displayed.

[00060] Referring now to Figs. 12 and 13 there are shown screenshots of another application, a phonebook, using the dynamic application area allocation process according to a preferred embodiment. The phonebook application handles many types of address information, such as name, telephone numbers, address, company, e-mail, etc. The command buttons 24 have the functions "Open" (tapping this command button opens the highlighted contact entry), "Call" (tapping this command button initiates a call to the highlighted or open contact entry), "Create message" (tapping this command button creates a message for the highlighted or open message), "Delete" (tapping this command button deletes the highlighted or open contact entry), and (Fig. 13) "Edit" (tapping this command button enables the editing of the open contact entry). The title area 21 indicates the phonebook contact list showing all stored contacts. A selection bar 27 below the title area allows the user to select alphabetic ranges in the contact list. The application area 22 is partitioned into application area section 22a and application area section 22b.

[00061] Application area section 22a displays the basic data of the contacts entries (the first and last name) in the contact list as a scrollable list of selectable items. The contact entries can be listed in accordance with user selectable criteria, such as alphabetical after

last or first name. A scroll bar 28 allows the user to scroll through the list by tapping or dragging with the stylus. The four-way navigation key 6 can also be used to scroll the list. When the phonebook is opened, about three quarters of the application area 22 is allocated to application area section 22a, which is in this state considered to be the temporarily larger application area section. This temporarily large section can therefore list a substantial number of contact entries, thus giving the user a good overview over the contact entry list.

[00062] One of the contact entries in the inbox is highlighted; default is the first contact entry on the list. The user can highlight a contact entry by tapping on it with the stylus, or by jumping the highlighting from one contact entry to the next on the list by using the four-way navigation key 6. Information concerning the highlighted contact entry is shown in temporarily smaller display area section 22b. Only about a quarter of the application area 22 is allocated to display area section 22b, and therefore only the contact name, company, title, primary phone number and small picture icon can be shown. Thus display area section 22b in this state functions as a preview window.

[00063] When the user selects the highlighted contact entry in the contact list, about three quarters of the display area 22 is allocated to display area section 22b which is then the temporarily larger application area section, as shown in Fig. 13. The contact number, title, all phone and fax numbers, e-mail address and physical address can now be shown in display area section 22b. In this state display area section 22b functions as a contact study window. Some of the contact details in application area section 22b can be selectable items.

[00064] If the user returns to the contact list, by e.g. tapping on one of the contact entries in the contact list in application area section 22a, or by tapping/dragging the scrollbar 28, three quarters of the display area 22 is allocated to display area section 22a, which is then again the temporarily larger application area section, and one quarter to display area 22b, as shown in Fig. 12. The user now has good overview over the contact list again. The user can also simply touch (or tap with the stylus) any of the display area sections to render it to the temporarily larger application area section.

[00065] Both when application area section 22a is the temporarily larger section and when application area section 22b is the temporarily larger section the command buttons 24 can be used. When application area section 22a is the temporarily larger section the buttons 24 can be used to open, call, create a message for, or delete contacts. When application area section 22b is the temporarily larger section the command buttons 24 can be used to call, create a message for, edit, or delete contacts.

[00066] Referring now to Fig. 14 and 15, screenshots are shown of a variation of the phonebook application described above. This variation could be realized by a change in the user controllable settings. In this variation the command buttons are not shown when application area section 22a with the contact entry list is the temporarily larger application area section. Once a user action causes application area 22b with the selected contact entry details/information to become the temporarily larger application area window the command buttons are displayed and can be used to work with the contact entry shown in application area section 22b. In

.s variation the size of display available for the ıtact list is maximized, giving the user even further ıproved overview of the list.

00067] The present invention may also include software ınd computer programs incorporating the process steps and instructions described above that are executed one or more. Fig. 16 is a block diagram of one embodiment of a typical apparatus 50 incorporating features of the present invention that may be used to practice the present invention. As shown, a computer system 52 may be linked to another computer system 54, such that the computers 52 and 54 are capable of sending information to each other and receiving information from each other. In one embodiment, computer system 50 could include a server computer 54 adapted to communicate with a network 56, such as for example, a mobile communication system. Computer systems 52 and 54 can be linked together in any conventional manner including a modem, hard wire connection, wireless connection or fiber optic link. Generally, information can be made available to both computer system 52 and 54 using a communication protocol typically sent over a communication channel or through a dial-up connection on ISDN line. Computer 52 is generally adapted to utilize program storage devices embodying machine readable program source code which is adapted to cause the computer 52 to perform the method steps of the present invention. The program storage devices incorporating features of the present invention may be devised, made and used as a component of a machine utilizing optics, magnetic properties and/or electronics to perform the procedures and methods of the present invention. In alternate embodiments, the program storage devices may include magnetic media such as a diskette or

computer hard drive, which is readable and executable by a computer. In other alternate embodiments, the program storage devices could include optical disks, read-only-memory ("ROM") floppy disks and semiconductor materials and chips.

[00068] Computer system 52 may also include a microprocessor for executing stored programs. Computer 52 may include a data storage device 58 on its program storage device for the storage of information and data. The computer program or software incorporating the processes and method steps incorporating features of the present invention may be stored in one or more computers 52 and 54 on an otherwise conventional program storage device. In one embodiment, computer 52 may include a user interface 51, and a display interface 53 from which features of the present invention can be accessed. The user interface 58 and the display interface 53 can be adapted to allow the input of queries and commands to the system, as well as present the results of the commands and queries.

[00069] The dynamic application area allocation process has been described with reference to two applications selected for illustration purposes. It is clear that this process can advantageously be used with many other types of applications, such as:

[00070] Printjobs: a list of queuing printjobs in one section and details of a highlighted printjobs in the other section;

[00071] downloads/uploads: a list of downloads/uploads in progress in one section and details of a highlighted download/upload in the other section;

[00072] image browsing: a list of image files in one section and a thumbnail of a highlighted image in the other section, the thumbnail changing to a larger image when the section concerned becomes the temporarily larger section;

[00073] calendar: a week overview in a first section, and details of a highlighted day in a second section, when the week overview section is the temporarily larger section, it indicates the calendar entries and possibly the times allocated to the calendar entries, whilst the second section displays the current day in more detail. When the application area allocation is switched, the day is shown in full detail in the second (now large) section with notes about the calendar entries and the fist section (now small) only displays a week overview.

[00074] The applications that operate with dynamic application space allocation in accordance with the present invention can be base software, lead software or native applications. The division of the application space does not need to be three quarter to one quarter, any uneven distribution of the application space, i.e. 60:40, 70:30, 75:25 or 80:20 can be applied. For display areas partitioned into three areas the division could e.g. be 50:25:25, 50:30:20 or 60:15:15. The selectable items in an application area section do not need to be presented in the form of a list; other arrays such as a grid can also be used, in particular if a plurality of icons or thumbnail type items are listed.

[00075] The ratio of the allocation is according to a further preferred embodiment be flexibly dependent on the amount of data to be presented in the respective sections, i.e. if a first section displays a list with

only two entries, it the ratio be e.g. 55/45, instead of 70/30 when the list has 30 entries. The ratio could also depend on the amount of information in the section that displays the detailed information. If an e-mail to be displayed in the section with detailed information is very short, the maximum size of the detailed segment could be limited to 35% of the application area. If the e-mail to be displayed is however very long, 80% of the application area could be allocated to the detailed section.

[00076] Although the present invention has been described in detail for purpose of illustration, it is understood that such detail is solely for that purpose, and variations can be made therein by those skilled in the art without departing from the scope of the invention.

C L A I M S

1. A mobile communication terminal comprising:

a user interface including a display component and an input component;

a processor being configured to control operation of said terminal including being configured to receive input from a user through the input component, and to run an application on said terminal;

said processor also being configured to show a partitioned application area with two or more application area sections on said display component when an application is running on the terminal;

said processor further being configured to at least temporarily define an initial one of said application area sections as a larger application area section as shown within the partitioned application area, and simultaneously at least temporarily define a complementary one of said application area sections as a smaller application area section as shown within the partitioned application area;

said processor moreover being configured to at least temporarily redefine said initial one of said application area sections as a smaller application area section as shown within the partitioned application area, and simultaneously at least

temporarily redefine said complementary one of said application area sections as a larger application area section as shown within the partitioned application area in response to user input; and

said processor being configured to allocate a ratio of respective areas between the larger application area section and the smaller application area section within said partitioned application area.

2. A mobile communication terminal according to claim 1, wherein a first one of said application area sections displays a plurality of selectable items with one of the items highlighted, and a second one of said application area sections displays details of the highlighted item.

3. A mobile communication terminal according to claim 2, wherein said processor is configured to redefine said second one of said application area sections as the larger application area section when the user selects a selectable item in said first one of said application area sections.

4. A mobile communication terminal according to claim 3, wherein said processor is configured to subsequently redefine said first one of said application area sections as the larger application area section when the second one of said application area sections is the larger application area section and the user selects an item or object in the second one of said application area sections.

5. A mobile communication terminal according to claim 3 or 4, wherein at least a part of the information displayed in the second one of said application area sections is in the form of selectable items when the second one of said application area sections is the larger application area section.

6. A mobile communication terminal according to claim 4 or 5, wherein the amount of information concerning the item selected in the first one of said application area sections is increased when the second one of said application area sections becomes the larger application area section.

7. A mobile communication terminal according to any of claims 1 to 6, wherein said display component and said input component comprises a touch screen.

8. A mobile communication terminal according to claim 7 wherein said processor is configured to display one or more command buttons on said touch screen simultaneously with said partitioned application area.

9. A mobile communication terminal according to claim 7, wherein said processor is configured to display one or more command buttons on said touchscreen only when one of one or more predetermined application areas is the larger application area section, and wherein the area used for displaying the command bottoms is taken from said partitioned application area.

10. A mobile communication terminal according to claim 9, wherein the function and number of the command buttons is specific for each of the application area sections.

11. A mobile communication terminal according to claim 7, wherein said application is a phone or address book, and one of said application area sections displays a list of selectable phone or address book entries of which one is highlighted, and another of said application area sections displays details concerning the highlighted phone or address book entry.

12. A mobile communication terminal according to any of claim 7 to 10, wherein said application is a messaging application, and one of said application area sections displays a list of received, sent, deleted or drafted messages of which one is highlighted, and another of said application area sections displays details concerning the highlighted message.

13. A method of operating a user interface of a mobile communication terminal having a display component and an input component, said method comprising the steps of:

running an application;

showing a partitioned application area with two or more application area sections on said display component;

temporarily defining an initial one of said application area sections as a larger application area section as shown within the partitioned application area;

and simultaneously at least temporarily defining a complementary one of said application area sections as a smaller application area section as shown within the partitioned area;

temporarily redefining said initial one of said application area sections as a smaller application area section as shown within the partitioned application area, and simultaneously at least temporarily redefining said complementary one of said application are sections as a larger application area section as shown within the partitioned application area in response to user input; and

allocating a ratio of respective areas between the larger application area section and the smaller application area section within said partitioned application area.

14. A method according to claim 13, further comprising the steps of displaying a plurality of selectable items with one of the items highlighted in a first one of said application area sections, and displaying in a second one of said application area sections details of the highlighted item.

15. A method according to claim 14, further comprising the step of redefining said second one of said application area sections as the larger application area section when the user selects a selectable item in said first one of said application area sections.

16. A method according to claim 15, further comprising the step of subsequently redefining said first one of said application area sections as the larger application area section when the second one of said application area sections is the larger application area section and the user selects an item or object in the second one of said application area sections.

17. A method according to claim 15 or 16, further comprising the step of displaying at least a part of the information in the second one of said application area sections in the form of selectable items when the second one of said application area sections is the larger application area section.

18. A method according to claim 16 or 17, further comprising the step of increasing the amount of information concerning the item selected in the first one of said application area sections when the second one of said application area sections becomes the larger application area section.

19. A method according to any of claim 13 to 18, wherein said display component and said input component comprises a touch screen.

20. A method according to claim 19, further comprising the step of displaying one or more command buttons on said touch screen simultaneously with said partitioned application area.

21. A method according to claim 19, further comprising the step of displaying one or more command buttons on said touchscreen only when one of one or more predetermined application areas is the larger application area section, and taking the area used for displaying said command buttons from said partitioned application area.

22. A method according to claim 19, wherein the function and the number of command buttons is specific for each of the application area sections.

23. A computer-readable medium containing instructions for controlling a mobile communication terminal with a display component and an input component to:

show a partitioned application area with two or more application area sections on said display component when an application is running;

temporarily define an initial one of said application area sections as a larger application area section as shown within the partitioned application area; and simultaneously at least temporarily define a complementary one of said application area sections as a smaller application area section as shown within the partitioned area;

temporarily redefining said initial one of said application area sections as a smaller application area section as shown within the partitioned application area, and simultaneously at least temporarily redefining said complementary one of

said application are sections as a larger application area section as shown within the partitioned application area in response to user input; and

allocating a ratio of respective areas between the larger application area section and the smaller application area section within said partitioned application area.

24. A computer-readable medium according to claim 23, wherein said ratio is larger than 1:1 and smaller than 1:0, said ratio preferably between being in the range between 3:2 and 9:1.

25. A computer-readable medium according to claim 24, wherein said ratio is redefined in response to the type and amount of information to be displayed in the respective application area sections.

26. A method of allocating display area of a user interface of a mobile communication terminal comprising:

initializing an application stored in the terminal;

designating a portion of the user interface as a primary area;

designating another portion of the user interface as a secondary area;

allocating, in an initial state of the user interface, a larger portion of the user interface display area to the primary area relative to the secondary area;

displaying a list of user selectable items in the primary area;

displaying at least a portion of a content of a highlighted one of the user selectable items in the secondary area;

expanding, in a second state of the user interface, a size of the secondary area and correspondingly reducing a size of the primary area, a transition from the first state to the second state occurring upon a selection of the highlighted one of the user selectable items;

displaying a content of the selected one of the user selectable items in the expanded secondary area; and

displaying at least a portion of the user selectable items in the reduced primary area.

27. The method of claim 26 further comprising:

selecting the reduced primary area;

reallocating a size of the reduced primary area to the initial state; and

reallocating a size of the expanded secondary area to the initial state.

28. The method of claim 26 further comprising allocating an area of the user interface for a title, the area for the title being adjacent to one of the primary area or the secondary area.

29. The method of claim 26 further comprising displaying at least one user selectable command key, the at least one command key being associated with the application.

30. The method of claim 26 further comprising:

identifying an object selected from the list of user selectable items in the primary area;

determining a display area required to display a content of the selected object; and in the second state:

reallocating a size of the secondary area to correspond proportionately to the display area required to display the content of the selected object; and

reducing a size of the primary area in a manner proportional to the reallocation of the size of the secondary area.

31. The method of claim 30 further comprising, upon selection of the reduced primary area, reallocating the size of the primary area and the size of the secondary area to the initial state.

32. The method of claim 26 further comprising, in the transition from the first state to the second state, simultaneously expanding the size of the secondary area and reducing the size of the primary area.

33. The method of claim 26 wherein, in the initial state, a size of the primary area in the initial state is larger than a size of the secondary area by approximately two to three times.

34. The method of claim 26 further comprising, in the initial state, allocating a size ratio of primary area to secondary area to be greater than approximately 2:1.

35. The method of claim 26 further comprising, in the second state, allocating a size ratio of secondary area to primary area to be greater than approximately 2:1.

36. The method of claim 26 further comprising, in the initial state, displaying a list view in the primary area and a preview view of a highlighted list item in the secondary area.

37. The method of claim 26 further comprising, in the second state, displaying a detailed information view of the selected item in the secondary area and a reduced list view in the primary area.

38. The method of claim 26 wherein, in the second state, a size of the secondary area in the second state is larger than a size of the primary area by approximately two to three times.

39. The method of claim 26 wherein, in the second state, the secondary area expands and displaces the primary area until a desired area size for the secondary area is reached.

40. The method of claim 26 further comprising, when the user interface is transitioning from the second state to the first state, the primary area displacing the secondary area as the primary area increases in size.

41. The method of claim 26 wherein, during a transition from the first state to the second state, the change in size of the secondary area and the change in size of the primary area occur simultaneously.

42. A user interface for a mobile communication terminal comprising:

a primary display area; and

a secondary display area, the secondary display area allocated a smaller portion of the user interface relative to the primary display area in an initial state;

at least one user selectable item in the primary display area that can be highlighted and selected; and

wherein upon highlighting of the at least one user selectable item in the primary display area, at least a portion of details associated with the highlighted item are displayed in the secondary display area.

43. The user interface of claim 42 further comprising:

a second state of the user interface, the secondary state comprising:

an expanded secondary display area upon selection of one of the at least one user selectable items in the primary display area, the expanded secondary display displaying a content of the selected item in the second state;

a reduced primary display area that is reduced in size by an amount corresponding to an increase in size of the expanded secondary area, the reduced primary display displaying only a portion of the at least one user selectable item from the initial state;

at least one command selection key in a portion of the user interface, the command selection key being associated with an application associated with the at least one user selectable item.

44. The user interface of claim 43 further comprising a title area adjacent to one of the primary and secondary display area.

45. A display for a graphical user interface comprising:

a dynamically sizeable first portion;

a dynamically sizeable second portion that responds in an inversely proportional manner to a change in size of the first portion;

a first state in which the first portion has a display area larger than a display area of the second portion; and

a second state in which the display area of the first portion decreases in response to an increase in display area of the second portion.

46. The display of claim 45 further comprising at least one command button associated with the first state.

47. The display of claim 45 further comprising at least one command button associated with the second state, the command button not being visible to the user until the user interface enters the second state.

48. The display of claim 45 wherein the first state and the second state are mutually exclusive.

49. The display of claim 45 further comprising a title area located adjacent to one of the first portion or the second portion.

50. The display of claim 45 wherein the first portion in the first state comprises a list view of user selectable objects and the second portion in the first state comprises a preview screen for a highlighted object in the list view, the preview screen displaying at least a portion of data associated with the highlighted object.

51. The display of claim 45 wherein the first portion in the second state comprises a partial view of the list view of user selectable objects and the second portion in the second state comprises a detailed view of the data associated with the selected object.

52. The display of claim 45 wherein a ratio of area size of first portion to second portion is greater than 2:1 in the first state.

53. The display of claim 45 wherein a ratio of area size of second portion to first portion is greater than 2:1 in the second state.

54. A computer program product comprising:

a computer useable medium having computer readable code means embodied therein for causing a computer to initialize an application stored in the terminal,

the computer readable code means in the computer program product comprising:

computer readable program code means for causing a computer to designate a portion of the user interface as a primary area;

computer readable program code means for causing a computer to designate another portion of the user interface as a secondary area;

computer readable program code means for causing a computer to, in an initial state of the user interface, allocate a larger portion of the user interface display area to the primary area relative to the secondary area;

computer readable program code means for causing a computer to display a list of user selectable items in the primary area;

computer readable program code means for causing a computer to display at least a portion of a content of one of the user selectable items in the secondary area when the user selectable item is highlighted in the primary area;

computer readable program code means for causing a computer to transition to a second state when the user selectable item is selected, the second state comprising expanding a size of the secondary area and correspondingly reducing a size of the primary area;

computer readable program code means for causing a computer to display a content of the selected user selectable item in the expanded secondary area; and

computer readable program code means for causing a computer to display at least a portion of the user selectable items in the reduced primary area.

55. An article of manufacture comprising:

a computer useable medium having computer readable program code means embodied therein for causing a computer to initialize an application stored in the terminal, the computer readable code means in the article of manufacture comprising:

computer readable program code means for causing a computer to designate a portion of the user interface as a primary area;

computer readable program code means for causing a computer to designate another portion of the user interface as a secondary area;

computer readable program code means for causing a computer to allocate a larger portion of the user interface display area to the primary area relative to the secondary area in an initial state of the user interface;

computer readable program code means for causing a computer to display a list of user selectable items in the primary area;

computer readable program code means for causing a computer to display at least a portion of a content of one of the user selectable items in the secondary area when the user selectable item is highlighted in the primary area;

computer readable program code means for causing a computer to expand a size of the secondary area and correspondingly reduce a size of the primary area in a second state when one of the user selectable items is selected;

computer readable program code means for causing a computer to display a content of the selected user selectable item in the expanded secondary area; and

computer readable program code means for causing a computer to display at least a portion of the user selectable items in the reduced primary area.

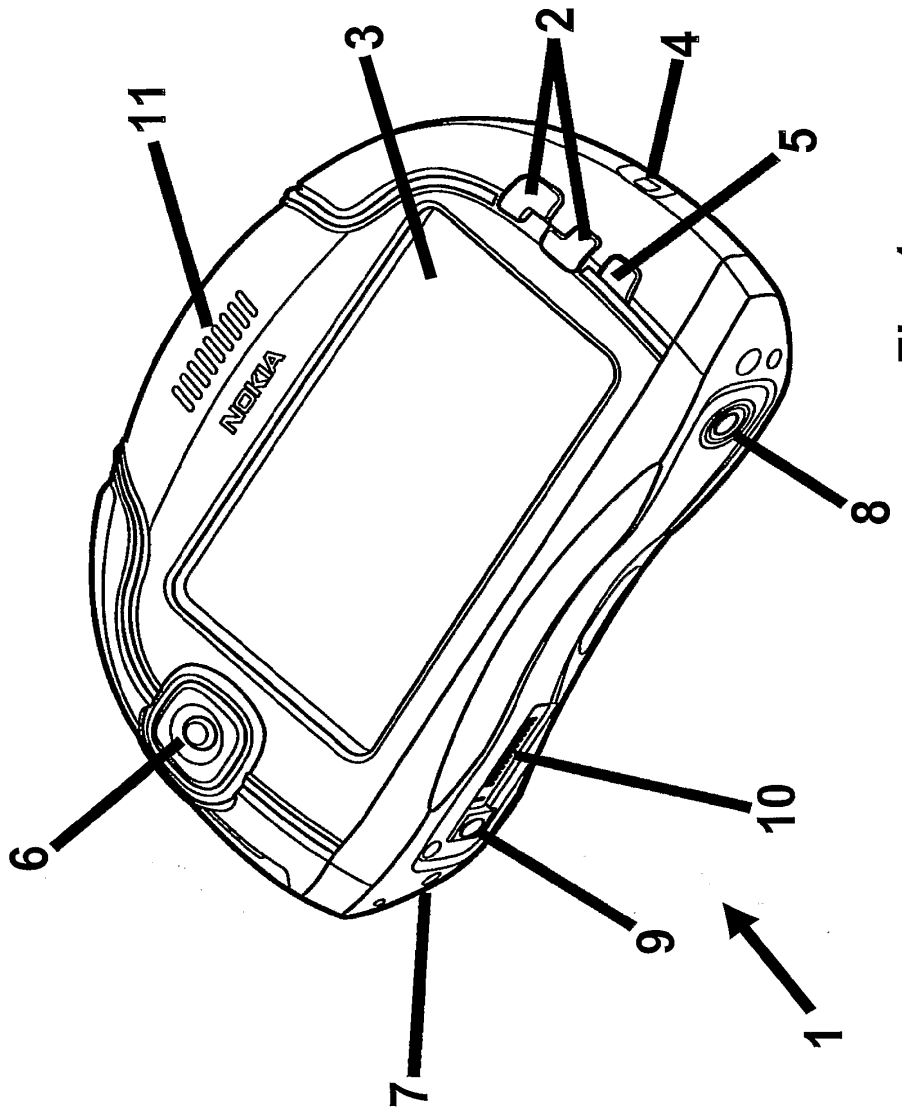


Fig. 1a

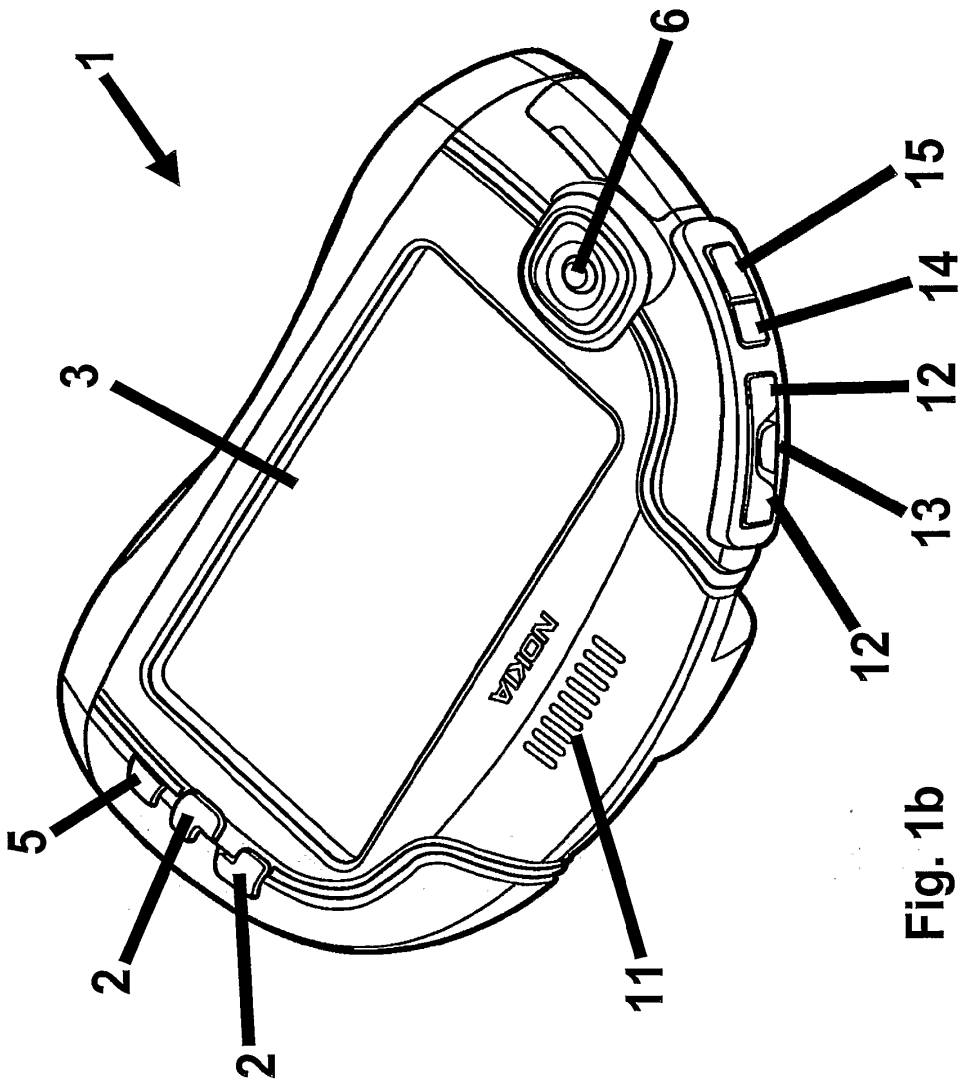


Fig. 1b

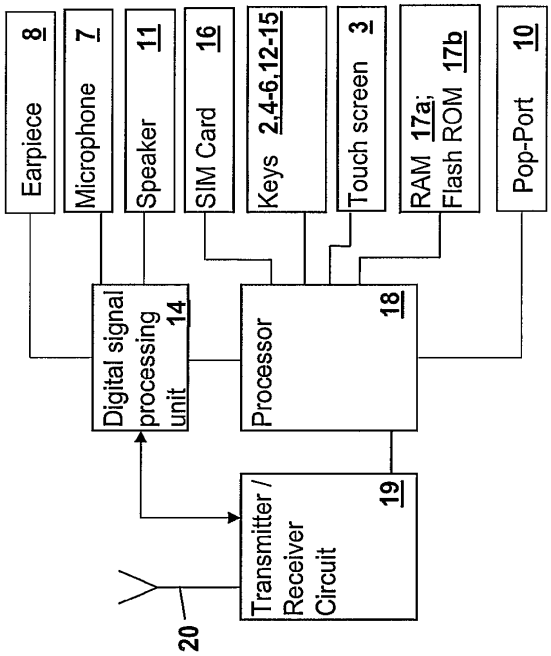

Earpiece 8
Microphone 7
Speaker 11
SIM Card 16
Keys 2,4-6,12-15
Touch screen 3
RAM 17a; Flash ROM 17b
Pop-Port 10
Digital signal processing unit 14
Processor 18
Transmitter / Receiver Circuit 19
20

Fig. 2

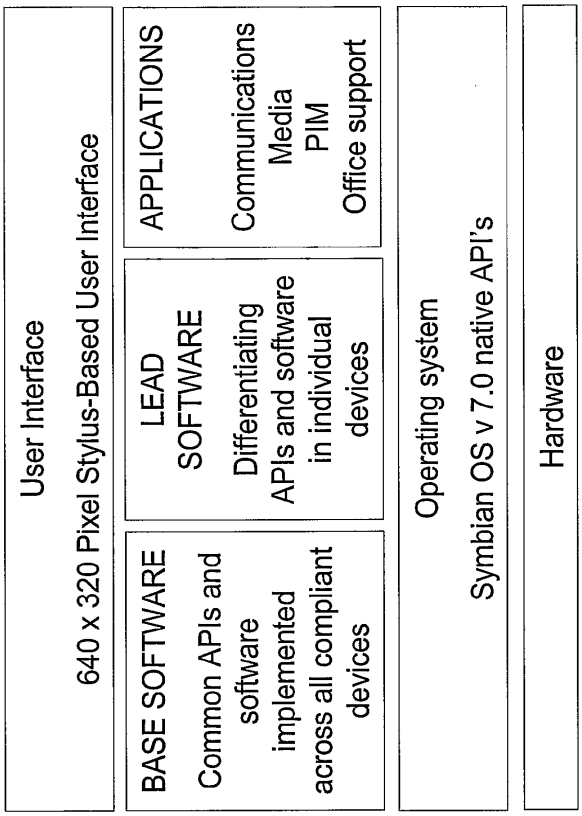

User Interface
640 x 320 Pixel Stylus-Based User Interface
BASE SOFTWARE
Common APIs and software implemented across all compliant devices
LEAD SOFTWARE
Differentiating APIs and software in individual devices
APPLICATIONS
Communications
Media
PIM
Office support
Operating system
Symbian OS v 7.0 native API's
Hardware

Fig. 3

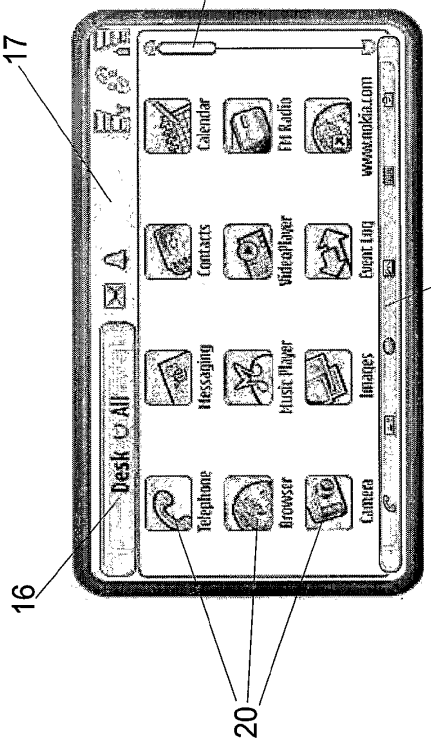


Fig. 4

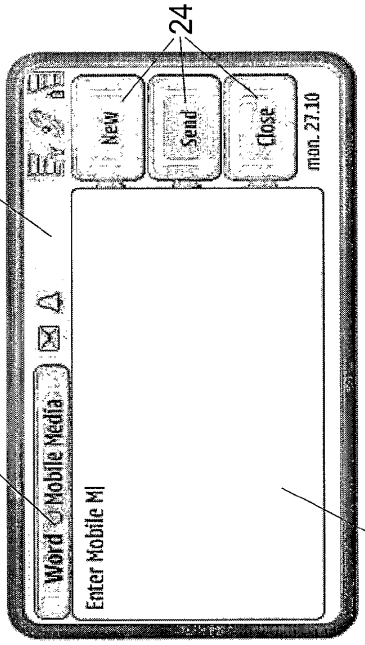


Fig. 6

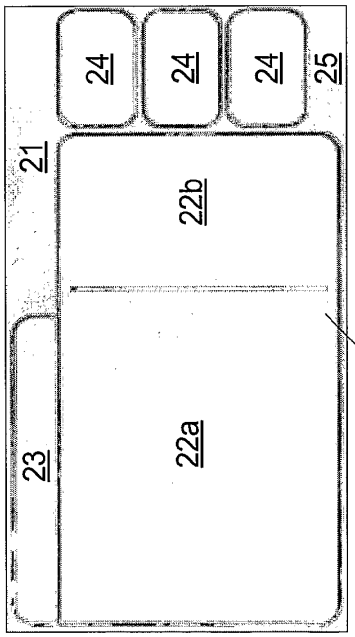


Fig. 5

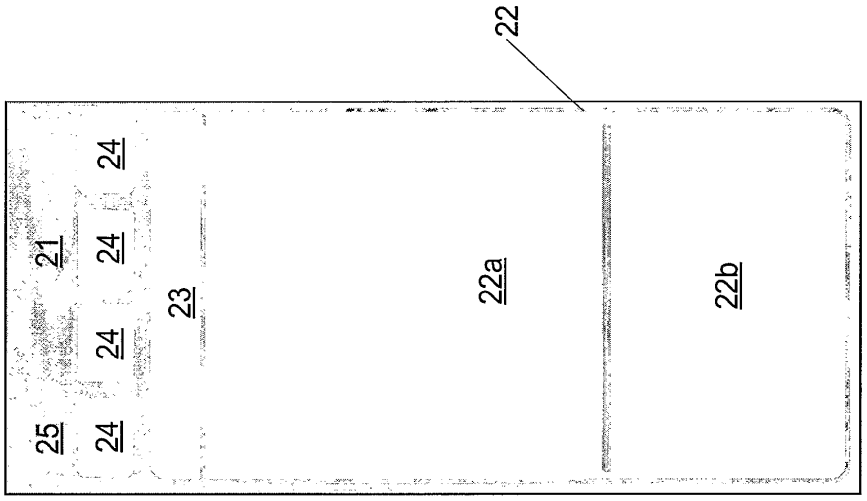


Fig. 8

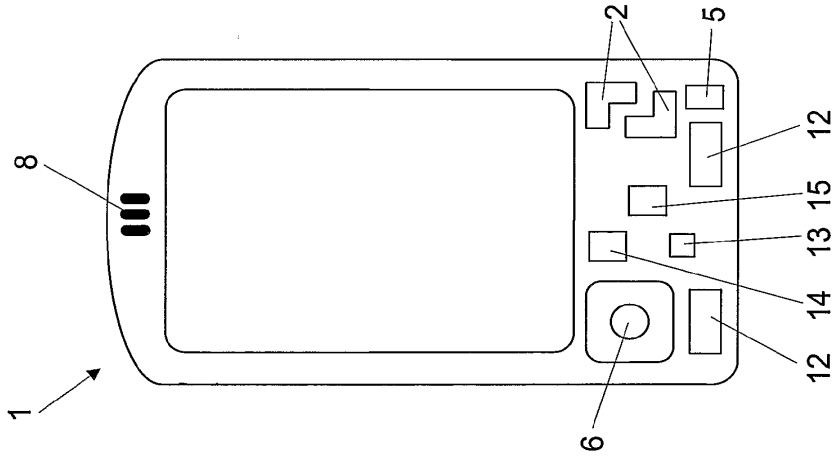


Fig. 7

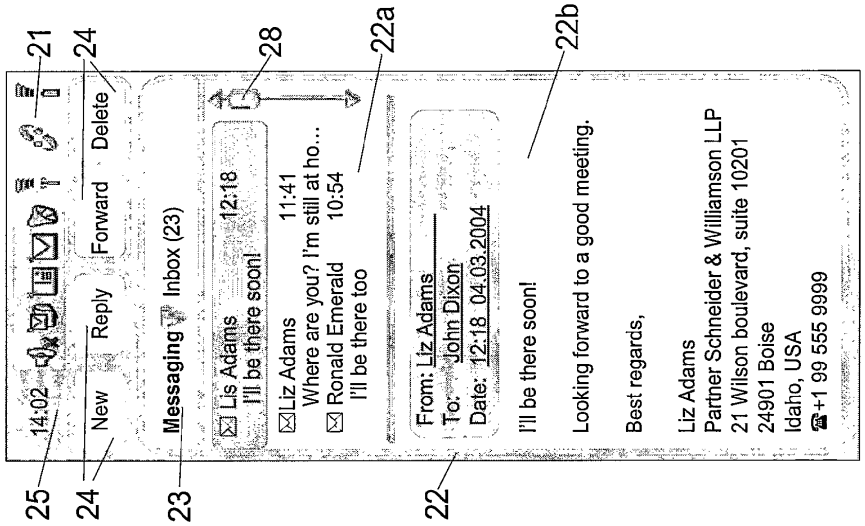

14:02
New
Reply
Forward
Delete
Messaging
Inbox (23)
Lis Adams 12:18
I'll be there soon!
Liz Adams 11:41
Where are you? I'm still at ho...
Ronald Emerald 10:54
I'll be there too
From: Liz Adams
To: John Dixon
Date: 12:18 04.03.2004
I'll be there soon!
Looking forward to a good meeting.
Best regards,
Liz Adams
Partner Schneider & Williamson LLP
21 Wilson boulevard, suite 10201
24901 Boise
Idaho, USA
+1 99 555 9999
21
24
25
23
28
22a
22b
22

Fig. 10

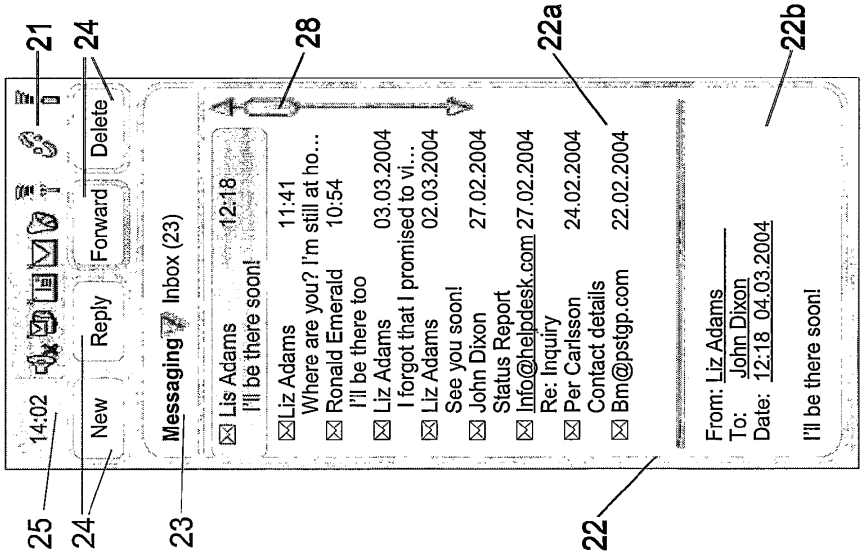

14:02
New
Reply
Forward
Delete
Messaging
Inbox (23)
Lis Adams 12:18
I'll be there soon!
Liz Adams 11:41
Where are you? I'm still at ho...
Ronald Emerald 10:54
I'll be there too
Liz Adams 03.03.2004
I forgot that I promised to vi...
Liz Adams 02.03.2004
See you soon!
John Dixon 27.02.2004
Status Report
Info@helpdesk.com 27.02.2004
Re: Inquiry
Per Carlsson 24.02.2004
Contact details
Bm@pstgp.com 22.02.2004
From: Liz Adams
To: John Dixon
Date: 12:18 04.03.2004
I'll be there soon!
21
24
25
23
28
22a
22b
22

Fig. 9

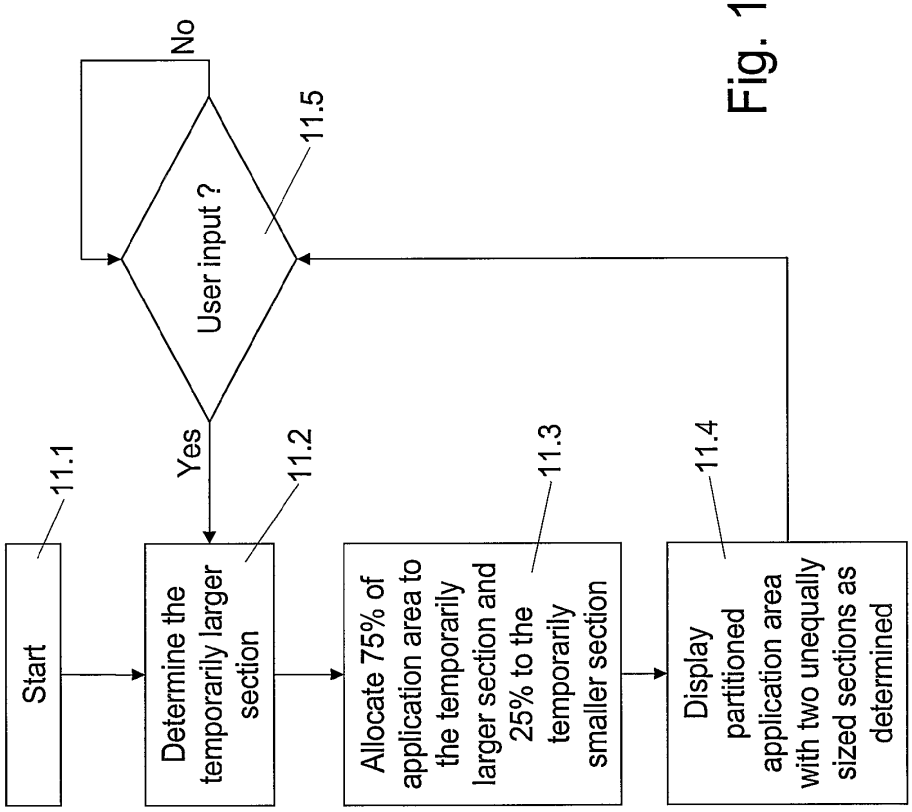

Start
11.1
Determine the temporarily larger section
11.2
Allocate 75% of application area to the temporarily larger section and 25% to the temporarily smaller section
11.3
Display partitioned application area with two unequally sized sections as determined
11.4
User input ?
11.5
Yes
No

Fig. 11

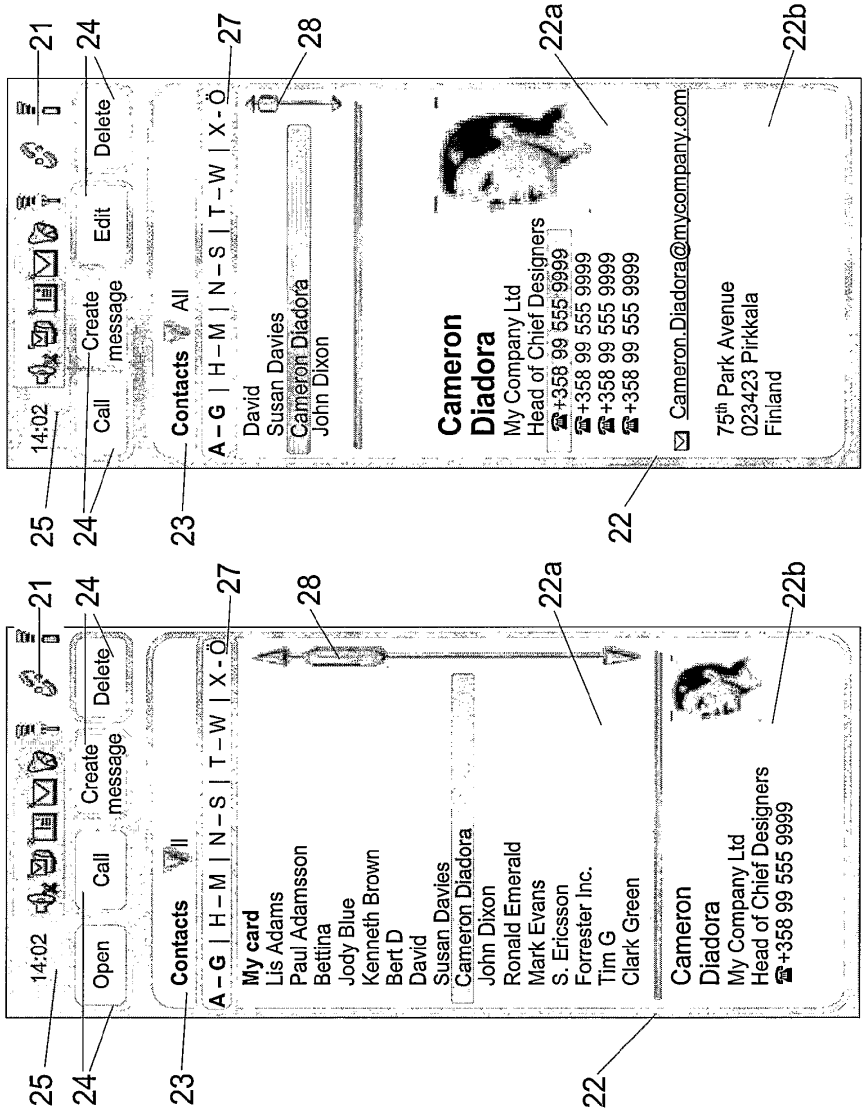

14:02
Open
Call
Create message
Delete
Contacts
All
A – G | H – M | N – S | T – W | X - Ö
My card
Lis Adams
Paul Adamsson
Bettina
Jody Blue
Kenneth Brown
Bert D
David
Susan Davies
Cameron Diadora
John Dixon
Ronald Emerald
Mark Evans
S. Ericsson
Forrester Inc.
Tim G
Clark Green
Cameron Diadora
My Company Ltd
Head of Chief Designers
+358 99 555 9999
21
22
22a
22b
23
24
25
27
28

Fig. 12

14:02
Call
Create message
Edit
Delete
Contacts
All
A – G | H – M | N – S | T – W | X - Ö
David
Susan Davies
Cameron Diadora
John Dixon
Cameron Diadora
My Company Ltd
Head of Chief Designers
+358 99 555 9999
+358 99 555 9999
+358 99 555 9999
Cameron.Diadora@mycompany.com
75th Park Avenue
023423 Pirkkala
Finland
21
22
22a
22b
23
24
25
27
28

Fig. 13

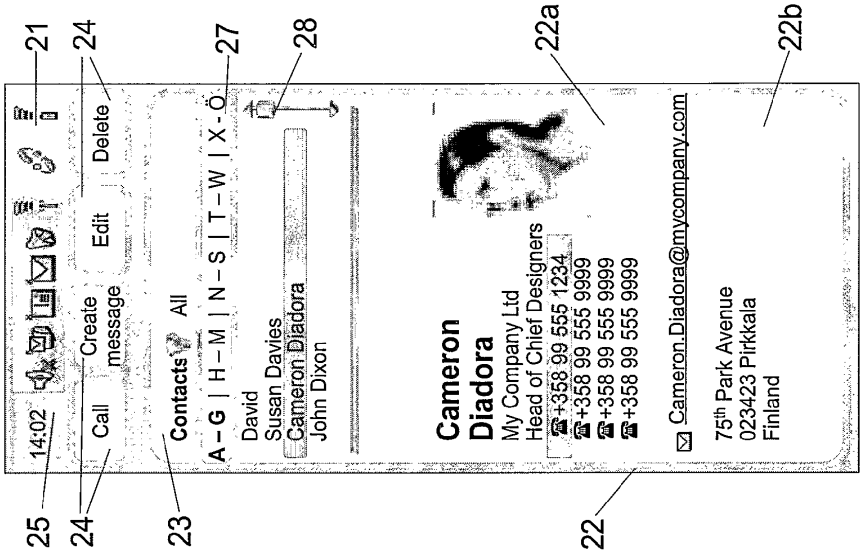


Fig. 15

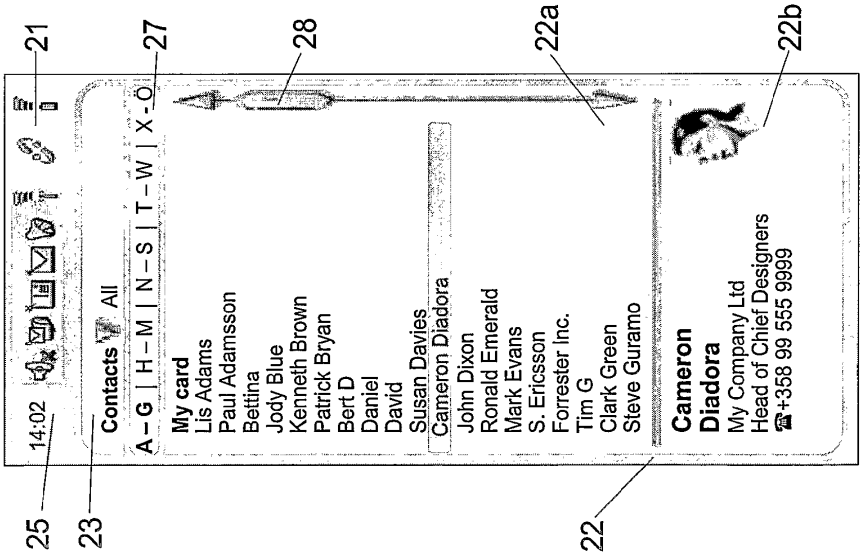


Fig. 14

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8 May 2013 (08.05.2013)

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61/747,278	29 December 2012 (29.12.2012)	US
61/778,191	12 March 2013 (12.03.2013)	US

(72) Inventor; and
(71) Applicant : **YKNOTS INDUSTRIES LLC** [US/US]; 1209 Orange Street, Wilmington, DE 19801 (US).

(74) Agents: **WILLIAMS, Gary S.** et al.; Morgan Lewis & Bockius LLP, 2 Palo Alto Square, 3000 El Camino Real, Suite 700, Palo Alto, CA 94306 (US).

(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, BN, BR, BW, BY, BZ, CA, CH, CL, 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, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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Published:

— *without international search report and to be republished upon receipt of that report (Rule 48.2(g))*

(54) **Title**: DEVICE, METHOD, AND GRAPHICAL USER INTERFACE FOR DISPLAYING USER INTERFACE OBJECTS CORRESPONDING TO AN APPLICATION

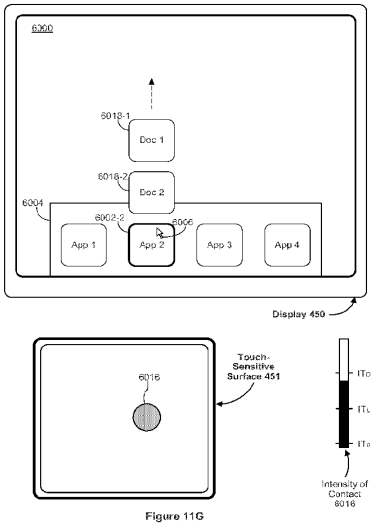


Figure 11G

(57) **Abstract**: An electronic device with a touch-sensitive surface and a display, that includes one or more sensors to detect intensity of contacts with the touch-sensitive surface, displays a plurality of application icons, where the plurality of application icons include a respective application icon corresponding to a respective application. While a focus selector is over the respective application icon, the device detects a gesture that includes a contact on the touch- sensitive surface; and in response to detecting the gesture: when the contact had a maximum intensity during the gesture that was below a respective intensity threshold, the device displays an application window of the respective application; and when the contact reached an intensity during the gesture that was above the respective intensity threshold, the device displays a plurality of user interface objects that correspond to the respective application.

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Device, Method, and Graphical User Interface for Displaying User Interface Objects Corresponding to an Application

RELATED APPLICATIONS

[0001] This application claims priority to U.S. Provisional Patent Application Serial No. 61/778,191, filed on March 12, 2013, entitled "Device, Method, and Graphical User Interface for Displaying User Interface Objects Corresponding to an Application;" U.S. Provisional Patent Application No. 61/747,278, filed December 29, 2012, entitled "Device, Method, and Graphical User Interface for Manipulating User Interface Objects with Visual and/or Haptic Feedback;" and U.S. Provisional Patent Application No. 61/688,227, filed May 9, 2012, entitled "Device, Method, and Graphical User Interface for Manipulating User Interface Objects with Visual and/or Haptic Feedback," which applications are incorporated by reference herein in their entirety.

[0002] This application is also related to the following: U.S. Provisional Patent Application Serial No. 61/778,092, filed on March 12, 2013, entitled "Device, Method, and Graphical User Interface for Selecting Object within a Group of Objects;" U.S. Provisional Patent Application Serial No. 61/778,125, filed on March 12, 2013, entitled "Device, Method, and Graphical User Interface for Navigating User Interface Hierarchies;" U.S. Provisional Patent Application Serial No. 61/778,156, filed on March 12, 2013, entitled "Device, Method, and Graphical User Interface for Manipulating Framed Graphical Objects;" U.S. Provisional Patent Application Serial No. 61/778,179, filed on March 12, 2013, entitled "Device, Method, and Graphical User Interface for Scrolling Nested Regions;" U.S. Provisional Patent Application Serial No. 61/778,171, filed on March 12, 2013, entitled "Device, Method, and Graphical User Interface for Displaying Additional Information in Response to a User Contact;" U.S. Provisional Patent Application Serial No. 61/778,211, filed on March 12, 2013, entitled "Device, Method, and Graphical User Interface for Facilitating User Interaction with Controls in a User Interface;" U.S. Provisional Patent Application Serial No. 61/778,239, filed on March 12, 2013, entitled "Device, Method, and Graphical User Interface for Forgoing Generation of Tactile Output for a Multi-Contact Gesture;" U.S. Provisional Patent Application Serial No. 61/778,284, filed on March 12, 2013, entitled "Device, Method, and Graphical User Interface for Providing Tactile Feedback for Operations Performed in a User Interface;" U.S. Provisional Patent Application Serial

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No. 61/778,287, filed on March 12, 2013, entitled "Device, Method, and Graphical User Interface for Providing Feedback for Changing Activation States of a User Interface Object;" U.S. Provisional Patent Application Serial No. 61/778,363, filed on March 12, 2013, entitled "Device, Method, and Graphical User Interface for Transitioning between Touch Input to Display Output Relationships;" U.S. Provisional Patent Application Serial No. 61/778,367, filed on March 12, 2013, entitled "Device, Method, and Graphical User Interface for Moving a User Interface Object Based on an Intensity of a Press Input;" U.S. Provisional Patent Application Serial No. 61/778,265, filed on March 12, 2013, entitled "Device, Method, and Graphical User Interface for Transitioning between Display States in Response to a Gesture;" U.S. Provisional Patent Application Serial No. 61/778,373, filed on March 12, 2013, entitled "Device, Method, and Graphical User Interface for Managing Activation of a Control Based on Contact Intensity;" U.S. Provisional Patent Application Serial No. 61/778,412, filed on March 13, 2013, entitled "Device, Method, and Graphical User Interface for Displaying Content Associated with a Corresponding Affordance;" U.S. Provisional Patent Application Serial No. 61/778,413, filed on March 13, 2013, entitled "Device, Method, and Graphical User Interface for Selecting User Interface Objects;" U.S. Provisional Patent Application Serial No. 61/778,414, filed on March 13, 2013, entitled "Device, Method, and Graphical User Interface for Moving and Dropping a User Interface Object;" U.S. Provisional Patent Application Serial No. 61/778,416, filed on March 13, 2013, entitled "Device, Method, and Graphical User Interface for Determining Whether to Scroll or Select Content;" and U.S. Provisional Patent Application Serial No. 61/778,418, filed on March 13, 2013, entitled "Device, Method, and Graphical User Interface for Switching between User Interfaces," which are incorporated herein by reference in their entirety.

[0003] This application is also related to the following: U.S. Provisional Patent Application Serial No. 61/645,033, filed on May 9, 2012, entitled "Adaptive Haptic Feedback for Electronic Devices;" U.S. Provisional Patent Application Serial No. 61/665,603, filed on June 28, 2012, entitled "Adaptive Haptic Feedback for Electronic Devices;" and U.S. Provisional Patent Application Serial No. 61/681,098, filed on August 8, 2012, entitled "Adaptive Haptic Feedback for Electronic Devices," which are incorporated herein by reference in their entirety.

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TECHNICAL FIELD

[0004] This relates generally to electronic devices with touch-sensitive surfaces, including but not limited to electronic devices with touch-sensitive surfaces that detect inputs for manipulating user interfaces.

BACKGROUND

[0005] The use of touch-sensitive surfaces as input devices for computers and other electronic computing devices has increased significantly in recent years. Exemplary touch-sensitive surfaces include touch pads and touch screen displays. Such surfaces are widely used to manipulate user interface objects on a display.

[0006] Exemplary manipulations include adjusting the position and/or size of one or more user interface objects or activating buttons or opening files/applications represented by user interface objects, as well as associating metadata with one or more user interface objects or otherwise manipulating user interfaces. Exemplary user interface objects include digital images, video, text, icons, control elements such as buttons and other graphics. A user will, in some circumstances, need to perform such manipulations on user interface objects in a file management program (e.g., Finder from Apple Inc. of Cupertino, California), an image management application (e.g., Aperture or iPhoto from Apple Inc. of Cupertino, California), a digital content (e.g., videos and music) management application (e.g., iTunes from Apple Inc. of Cupertino, California), a drawing application, a presentation application (e.g., Keynote from Apple Inc. of Cupertino, California), a word processing application (e.g., Pages from Apple Inc. of Cupertino, California), a website creation application (e.g., iWeb from Apple Inc. of Cupertino, California), a disk authoring application (e.g., iDVD from Apple Inc. of Cupertino, California), or a spreadsheet application (e.g., Numbers from Apple Inc. of Cupertino, California).

[0007] But existing methods for performing these manipulations are cumbersome and inefficient. In addition, existing methods take longer than necessary, thereby wasting energy. This latter consideration is particularly important in battery-operated devices.

SUMMARY

[0008] Accordingly, there is a need for electronic devices with faster, more efficient methods and interfaces for manipulating user interfaces. Such methods and interfaces optionally complement or replace conventional methods for manipulating user interfaces.

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Such methods and interfaces reduce the cognitive burden on a user and produce a more efficient human-machine interface. For battery-operated devices, such methods and interfaces conserve power and increase the time between battery charges.

[0009] The above deficiencies and other problems associated with user interfaces for electronic devices with touch-sensitive surfaces are reduced or eliminated by the disclosed devices. In some embodiments, the device is a desktop computer. In some embodiments, the device is portable (e.g., a notebook computer, tablet computer, or handheld device). In some embodiments, the device has a touchpad. In some embodiments, the device has a touch-sensitive display (also known as a "touch screen" or "touch screen display"). In some embodiments, the device has a graphical user interface (GUI), one or more processors, memory and one or more modules, programs or sets of instructions stored in the memory for performing multiple functions. In some embodiments, the user interacts with the GUI primarily through finger contacts and gestures on the touch-sensitive surface. In some embodiments, the functions optionally include image editing, drawing, presenting, word processing, website creating, disk authoring, spreadsheet making, game playing, telephoning, video conferencing, e-mailing, instant messaging, workout support, digital photographing, digital videoing, web browsing, digital music playing, and/or digital video playing. Executable instructions for performing these functions are, optionally, included in a non-transitory computer readable storage medium or other computer program product configured for execution by one or more processors.

[0010] There is a need for electronic devices with faster, more efficient methods and interfaces for previewing content. Such methods and interfaces may complement or replace conventional methods for previewing content. Such methods and interfaces reduce the cognitive burden on a user and produce a more efficient human-machine interface. For battery-operated devices, such methods and interfaces conserve power and increase the time between battery charges.

[0011] In accordance with some embodiments, a method is performed at an electronic device with a display, a touch-sensitive surface, and one or more sensors to detect intensity of contacts with the touch-sensitive surface. The method includes: displaying a plurality of document icons, including a respective document icon corresponding to a respective electronic document associated with a respective application; and while a focus selector is over the respective document icon, detecting a gesture that includes a contact on the touch-sensitive surface. The method further includes, in response to detecting the gesture: in

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accordance with a determination that the contact had a maximum intensity during the gesture that was below a respective intensity threshold, displaying the electronic document in a new application window of the respective application; and in accordance with a determination that the contact reached an intensity during the gesture that was above the respective intensity threshold, displaying a preview of the respective electronic document without displaying a new application window of the respective application.

[0012] In accordance with some embodiments, an electronic device includes a display unit configured to display a plurality of document icons, including a respective document icon corresponding to a respective electronic document associated with a respective application; a touch-sensitive surface unit configured to receive gestures that include contacts; one or more sensor units configured to detect intensity of contacts with the touch-sensitive surface unit; and a processing unit coupled to the display unit, the touch-sensitive surface unit, and the sensor units. The processing unit is configured to: while a focus selector is over the respective document icon, detect a gesture that includes a contact on the touch-sensitive surface unit. The processing unit is further configured to, in response to detecting the gesture: in accordance with a determination that the contact had a maximum intensity during the gesture that was below a respective intensity threshold, enable display of the electronic document in a new application window of the respective application; and in accordance with a determination that the contact reached an intensity during the gesture that was above the respective intensity threshold, enable display of a preview of the respective electronic document without enabling display of a new application window of the respective application.

[0013] Thus, electronic devices with displays, touch-sensitive surfaces, and one or more sensors to detect intensity of contacts with the touch-sensitive surface are provided with faster, more efficient methods and interfaces for previewing content, thereby increasing the effectiveness, efficiency, and user satisfaction with such devices. Such methods and interfaces may complement or replace conventional methods for previewing content.

[0014] There is a need for electronic devices with faster, more efficient methods and interfaces for previewing content. Such methods and interfaces may complement or replace conventional methods for previewing content. Such methods and interfaces reduce the cognitive burden on a user and produce a more efficient human-machine interface. For battery-operated devices, such methods and interfaces conserve power and increase the time between battery charges.

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[0015] In accordance with some embodiments, a method is performed at an electronic device with a display, a touch-sensitive surface, and one or more sensors to detect intensity of contacts with the touch-sensitive surface. The method includes: displaying a frame for previewing content, where the frame corresponds to a plurality of content items; detecting movement of a contact across the touch-sensitive surface; moving a focus selector across the frame in accordance with the movement of the contact across the touch-sensitive surface; sequentially displaying, in the frame, previews of respective content items in the plurality of content items in accordance with the movement of the focus selector across the frame, where a size of the previews is constrained to a size of the frame; while a respective preview of a respective content item is displayed in the frame at a first size, detecting an increase in intensity of the contact; in response to detecting the increase in intensity of the contact, increasing the size of the respective preview to a second size larger than the size of the frame; while displaying the respective preview at the second size, detecting a decrease in intensity of the contact; and in response to detecting the decrease in intensity of the contact, reducing the size of the respective preview to the first size.

[0016] In accordance with some embodiments, an electronic device includes a display unit configured to display a frame for previewing content, where the frame corresponds to a plurality of content items; a touch-sensitive surface unit configured to receive contacts; one or more sensor units configured to detect intensity of contacts with the touch-sensitive surface unit; and a processing unit coupled to the display unit, the touch-sensitive surface unit, and the sensor units. The processing unit is configured to detect movement of a contact across the touch-sensitive surface unit; move a focus selector across the frame in accordance with the movement of the contact across the touch-sensitive surface unit; enable sequential display of, in the frame, previews of respective content items in the plurality of content items in accordance with the movement of the focus selector across the frame, wherein a size of the previews is constrained to a size of the frame; while a respective preview of a respective content item is displayed in the frame at a first size, detect an increase in intensity of the contact; in response to detecting the increase in intensity of the contact, increase the size of the respective preview to a second size larger than the size of the frame; while displaying the respective preview at the second size, detect a decrease in intensity of the contact; and in response to detecting the decrease in intensity of the contact, reduce the size of the respective preview to the first size.

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[0017] Thus, electronic devices with displays, touch-sensitive surfaces and one or more sensors to detect intensity of contacts with the touch-sensitive surface are provided with faster, more efficient methods and interfaces for previewing content, thereby increasing the effectiveness, efficiency, and user satisfaction with such devices. Such methods and interfaces may complement or replace conventional methods for previewing content.

[0018] There is a need for electronic devices with faster, more efficient methods and interfaces for displaying user interface objects corresponding to an application. Such methods and interfaces may complement or replace conventional methods for displaying user interface objects corresponding to an application. Such methods and interfaces reduce the cognitive burden on a user and produce a more efficient human-machine interface. For battery-operated devices, such methods and interfaces conserve power and increase the time between battery charges.

[0019] In accordance with some embodiments, a method is performed at an electronic device with a display, a touch-sensitive surface and one or more sensors to detect intensity of contacts with the touch-sensitive surface. The method includes: displaying a plurality of application icons, where the plurality of application icons includes a respective application icon corresponding to a respective application; while a focus selector is over the respective application icon, detecting a gesture that includes a contact on the touch-sensitive surface; and in response to detecting the gesture: in accordance with a determination that the contact had a maximum intensity during the gesture that was below a respective intensity threshold, displaying an application window of the respective application; and in accordance with a determination that the contact reached an intensity during the gesture that was above the respective intensity threshold, displaying a plurality of user interface objects that correspond to the respective application.

[0020] In accordance with some embodiments, an electronic device includes a display unit configured to display a plurality of application icons, where the plurality of application icons include a respective application icon corresponding to a respective application; a touch-sensitive surface unit configured to receive gestures including contacts; one or more sensor units configured to detect intensity of contacts with the touch-sensitive surface unit; and a processing unit coupled to the display unit, the touch-sensitive surface unit and the sensor units. The processing unit is configured to: while a focus selector is over the respective application icon, detect a gesture that includes a contact on the touch-sensitive surface unit; and in response to detecting the gesture: in accordance with a determination that the contact

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had a maximum intensity during the gesture that was below a respective intensity threshold, enable display of an application window of the respective application; and in accordance with a determination that the contact reached an intensity during the gesture that was above the respective intensity threshold, enable display of a plurality of user interface objects that correspond to the respective application.

[0021] Thus, electronic devices with displays, touch-sensitive surfaces and one or more sensors to detect intensity of contacts with the touch-sensitive surface are provided with faster, more efficient methods and interfaces for displaying user interface objects corresponding to an application, thereby increasing the effectiveness, efficiency, and user satisfaction with such devices. Such methods and interfaces may complement or replace conventional methods for displaying user interface objects corresponding to an application.

[0022] In accordance with some embodiments, an electronic device includes a display, a touch-sensitive surface, optionally one or more sensors to detect intensity of contacts with the touch-sensitive surface, one or more processors, memory, and one or more programs; the one or more programs are stored in the memory and configured to be executed by the one or more processors and the one or more programs include instructions for performing the operations of any of the methods referred to in paragraph [0043]. In accordance with some embodiments, a graphical user interface on an electronic device with a display, a touch-sensitive surface, optionally one or more sensors to detect intensity of contacts with the touch-sensitive surface, a memory, and one or more processors to execute one or more programs stored in the memory includes one or more of the elements displayed in any of the methods referred to in paragraph [0043], which are updated in response to inputs, as described in any of the methods referred to in paragraph [0043]. In accordance with some embodiments, a computer readable storage medium has stored therein instructions which when executed by an electronic device with a display, a touch-sensitive surface, and optionally one or more sensors to detect intensity of contacts with the touch-sensitive surface, cause the device to perform the operations of any of the methods referred to in paragraph [0043]. In accordance with some embodiments, an electronic device includes: a display, a touch-sensitive surface, and optionally one or more sensors to detect intensity of contacts with the touch-sensitive surface; and means for performing the operations of any of the methods referred to in paragraph [0043]. In accordance with some embodiments, an information processing apparatus, for use in an electronic device with a display and a touch-sensitive surface, optionally one or more sensors to detect intensity of contacts with the

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touch-sensitive surface, includes means for performing the operations of any of the methods referred to in paragraph [0043].

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] For a better understanding of the various described embodiments, reference should be made to the Description of Embodiments below, in conjunction with the following drawings in which like reference numerals refer to corresponding parts throughout the figures.

[0024] Figure 1A is a block diagram illustrating a portable multifunction device with a touch-sensitive display in accordance with some embodiments.

[0025] Figure 1B is a block diagram illustrating exemplary components for event handling in accordance with some embodiments.

[0026] Figure 2 illustrates a portable multifunction device having a touch screen in accordance with some embodiments.

[0027] Figure 3 is a block diagram of an exemplary multifunction device with a display and a touch-sensitive surface in accordance with some embodiments.

[0028] Figure 4A illustrates an exemplary user interface for a menu of applications on a portable multifunction device in accordance with some embodiments.

[0029] Figure 4B illustrates an exemplary user interface for a multifunction device with a touch-sensitive surface that is separate from the display in accordance with some embodiments.

[0030] Figures 5A-5S illustrate exemplary user interfaces for previewing content in accordance with some embodiments.

[0031] Figures 6A-6C are flow diagrams illustrating a method of previewing content in accordance with some embodiments.

[0032] Figure 7 is a functional block diagram of an electronic device in accordance with some embodiments.

[0033] Figures 8A-8W illustrate exemplary user interfaces for previewing content in accordance with some embodiments.

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[0034] Figures 9A-9C are flow diagrams illustrating a method of previewing content in accordance with some embodiments.

[0035] Figure 10 is a functional block diagram of an electronic device in accordance with some embodiments.

[0036] Figures 11A-11P illustrate exemplary user interfaces for displaying user interface objects corresponding to an application in accordance with some embodiments.

[0037] Figures 12A-12B are flow diagrams illustrating a method of displaying user interface objects corresponding to an application in accordance with some embodiments.

[0038] Figure 13 is a functional block diagram of an electronic device in accordance with some embodiments.

DESCRIPTION OF EMBODIMENTS

[0039] The methods, devices and GUIs described herein provide visual and/or haptic feedback that makes manipulation of user interface objects more efficient and intuitive for a user. For example, in a system where the clicking action of a trackpad is decoupled from the contact intensity (e.g., contact force, contact pressure, or a substitute therefore) that is needed to reach an activation threshold, the device can generate different tactile outputs (e.g., "different clicks") for different activation events (e.g., so that clicks that accomplish a particular result are differentiated from clicks that do not produce any result or that accomplish a different result from the particular result). Additionally, tactile outputs can be generated in response to other events that are not related to increasing intensity of a contact, such as generating a tactile output (e.g., a "detent") when a user interface object is moved to a particular position, boundary or orientation, or when an event occurs at the device.

[0040] Additionally, in a system where a trackpad or touch-screen display is sensitive to a range of contact intensity that includes more than one or two specific intensity values (e.g., more than a simple on/off, binary intensity determination), the user interface can provide responses (e.g., visual or tactile cues) that are indicative of the intensity of the contact within the range. In some implementations, a pre-activation-threshold response and/or a post-activation-threshold response to an input are displayed as continuous animations. As one example of such a response, a preview of an operation is displayed in response to detecting an increase in contact intensity that is still below an activation threshold for performing the operation. As another example of such a response, an animation associated with an operation

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continues even after the activation threshold for the operation has been reached. Both of these examples provide a user with a continuous response to the force or pressure of a user's contact, which provides a user with visual and/or haptic feedback that is richer and more intuitive. More specifically, such continuous force responses give the user the experience of being able to press lightly to preview an operation and/or press deeply to push "past" or "through" a predefined user interface state corresponding to the operation.

[0041] Additionally, for a device with a touch-sensitive surface that is sensitive to a range of contact intensity, multiple contact intensity thresholds can be monitored by the device and different functions can be mapped to different contact intensity thresholds. This serves to increase the available "gesture space" providing easy access to advanced features for users who know that increasing the intensity of a contact at or beyond a second "deep press" intensity threshold will cause the device to perform a different operation from an operation that would be performed if the intensity of the contact is between a first "activation" intensity threshold and the second "deep press" intensity threshold. An advantage of assigning additional functionality to a second "deep press" intensity threshold while maintaining familiar functionality at a first "activation" intensity threshold is that inexperienced users who are, in some circumstances, confused by the additional functionality can use the familiar functionality by just applying an intensity up to the first "activation" intensity threshold, whereas more experienced users can take advantage of the additional functionality by applying an intensity at the second "deep press" intensity threshold.

[0042] Additionally, for a device with a touch-sensitive surface that is sensitive to a range of contact intensity, the device can provide additional functionality by allowing users to perform complex operations with a single continuous contact. For example, when selecting a group of objects, a user can move a continuous contact around the touch-sensitive surface and can press while dragging (e.g., applying an intensity greater than a "deep press" intensity threshold) to add additional elements to a selection. In this way, a user can intuitively interact with a user interface where pressing harder with a contact causes objects in the user interface to be "stickier."

[0043] A number of different approaches to providing an intuitive user interface on a device where a clicking action is decoupled from the force that is needed to reach an activation threshold and/or the device is sensitive to a wide range of contact intensities are described below. Using one or more of these approaches (optionally in conjunction with each other) helps to provide a user interface that intuitively provides users with additional

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information and functionality, thereby reducing the user's cognitive burden and improving the human-machine interface. Such improvements in the human-machine interface enable users to use the device faster and more efficiently. For battery-operated devices, these improvements conserve power and increase the time between battery charges. For ease of explanation, systems, methods and user interfaces for including illustrative examples of some of these approaches are described below, as follows:

- Many electronic devices allow users to interact with items such as documents. A document may reside in a folder or be attached to another document, such as an email. In some methods, if the user wants to look at the contents of the document, the user would have to open the document in the associated application. This can be tedious and wasteful of system resources, as the user may merely wish to view the document contents quickly. The embodiments described below improve on these methods of interacting with documents by allowing the user to preview a document or open the document based on the intensity of a contact corresponding to a focus selector interacting with a document icon. In particular, Figures 5A-5S illustrate exemplary user interfaces for previewing content. Figures 6A-6C are flow diagrams illustrating a method of previewing content. The user interfaces in Figures 5A-5S are used to illustrate the processes in Figures 6A-6C.
- Many electronic devices have user interfaces for browsing content items, such as photos. The content items are, optionally, organized into multiple sets of items. In some methods, to preview the items within a set, a user would need to first select and open the desired set of items as in opening a folder, and then preview the items in the set. This adds additional steps to the previewing process and can make the process tedious if the user is previewing items in multiple sets. The embodiments below improve on these methods by enabling a user to preview items within a set in accordance with movement and intensity of a contact. In particular, 8A-8W illustrate exemplary user interfaces for previewing content. Figures 9A-9C are flow diagrams illustrating a method of previewing content. The user interfaces in Figures 8A-8W are used to illustrate the processes in Figures 9A-9C.
- At any one time, a user may have multiple windows for any one application opened, and not all of them are displayed. Some of these windows or documents are, optionally, minimized or hidden by other windows. Further, an application may have a recently opened documents history. In some methods, a user keeps track of the

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multiple windows by looking at a taskbar or opening a task list, both of which are, optionally, hidden at first. To look at a recently opened documents history for an application, the user has to open the application. These methods add additional steps for the user and can be confusing and time consuming. The embodiments described below improve on these methods by providing a more efficient way to review currently opened windows and a history of recently opened documents in accordance with an intensity of a contact. In particular, Figures 11A-11P illustrate exemplary user interfaces for displaying user interface objects corresponding to an application. Figures 12A-12B are flow diagrams illustrating a method of displaying user interface objects corresponding to an application. The user interfaces in Figures 11A-11P are used to illustrate the processes in Figures 12A-12B.

EXEMPLARY DEVICES

[0044] Reference will now be made in detail to embodiments, examples of which are illustrated in the accompanying drawings. In the following detailed description, numerous specific details are set forth in order to provide a thorough understanding of the various described embodiments. However, it will be apparent to one of ordinary skill in the art that the various described embodiments may be practiced without these specific details. In other instances, well-known methods, procedures, components, circuits, and networks have not been described in detail so as not to unnecessarily obscure aspects of the embodiments.

[0045] It will also be understood that, although the terms first, second, etc. are, in some instances, used herein to describe various elements, these elements should not be limited by these terms. These terms are only used to distinguish one element from another. For example, a first contact could be termed a second contact, and, similarly, a second contact could be termed a first contact, without departing from the scope of the various described embodiments. The first contact and the second contact are both contacts, but they are not the same contact.

[0046] The terminology used in the description of the various described embodiments herein is for the purpose of describing particular embodiments only and is not intended to be limiting. As used in the description of the various described embodiments and the appended claims, the singular forms “a”, “an” and “the” are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will also be understood that the term "and/or" as used herein refers to and encompasses any and all possible combinations of one

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or more of the associated listed items. It will be further understood that the terms "includes," "including," "comprises," and/or "comprising," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

[0047] As used herein, the term "if" is, optionally, construed to mean "when" or "upon" or "in response to determining" or "in response to detecting," depending on the context. Similarly, the phrase "if it is determined" or "if [a stated condition or event] is detected" is, optionally, construed to mean "upon determining" or "in response to determining" or "upon detecting [the stated condition or event]" or "in response to detecting [the stated condition or event]," depending on the context.

[0048] Embodiments of electronic devices, user interfaces for such devices, and associated processes for using such devices are described. In some embodiments, the device is a portable communications device, such as a mobile telephone, that also contains other functions, such as PDA and/or music player functions. Exemplary embodiments of portable multifunction devices include, without limitation, the iPhone®, iPod Touch®, and iPad® devices from Apple Inc. of Cupertino, California. Other portable electronic devices, such as laptops or tablet computers with touch-sensitive surfaces (e.g., touch screen displays and/or touch pads), are, optionally, used. It should also be understood that, in some embodiments, the device is not a portable communications device, but is a desktop computer with a touch-sensitive surface (e.g., a touch screen display and/or a touch pad).

[0049] In the discussion that follows, an electronic device that includes a display and a touch-sensitive surface is described. It should be understood, however, that the electronic device optionally includes one or more other physical user-interface devices, such as a physical keyboard, a mouse and/or a joystick.

[0050] The device typically supports a variety of applications, such as one or more of the following: a drawing application, a presentation application, a word processing application, a website creation application, a disk authoring application, a spreadsheet application, a gaming application, a telephone application, a video conferencing application, an e-mail application, an instant messaging application, a workout support application, a photo management application, a digital camera application, a digital video camera

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application, a web browsing application, a digital music player application, and/or a digital video player application.

[0051] The various applications that are executed on the device optionally use at least one common physical user-interface device, such as the touch-sensitive surface. One or more functions of the touch-sensitive surface as well as corresponding information displayed on the device are, optionally, adjusted and/or varied from one application to the next and/or within a respective application. In this way, a common physical architecture (such as the touch-sensitive surface) of the device optionally supports the variety of applications with user interfaces that are intuitive and transparent to the user.

[0052] Attention is now directed toward embodiments of portable devices with touch-sensitive displays. Figure 1A is a block diagram illustrating portable multifunction device 100 with touch-sensitive displays 112 in accordance with some embodiments. Touch-sensitive display 112 is sometimes called a "touch screen" for convenience, and is sometimes known as or called a touch-sensitive display system. Device 100 includes memory 102 (which optionally includes one or more computer readable storage mediums), memory controller 122, one or more processing units (CPU's) 120, peripherals interface 118, RF circuitry 108, audio circuitry 110, speaker 111, microphone 113, input/output (I/O) subsystem 106, other input or control devices 116, and external port 124. Device 100 optionally includes one or more optical sensors 164. Device 100 optionally includes one or more intensity sensors 165 for detecting intensity of contacts on device 100 (e.g., a touch-sensitive surface such as touch-sensitive display system 112 of device 100). Device 100 optionally includes one or more tactile output generators 167 for generating tactile outputs on device 100 (e.g., generating tactile outputs on a touch-sensitive surface such as touch-sensitive display system 112 of device 100 or touchpad 355 of device 300). These components optionally communicate over one or more communication buses or signal lines 103.

[0053] As used in the specification and claims, the term "intensity" of a contact on a touch-sensitive surface refers to the force or pressure (force per unit area) of a contact (e.g., a finger contact) on the touch sensitive surface, or to a substitute (proxy) for the force or pressure of a contact on the touch sensitive surface. The intensity of a contact has a range of values that includes at least four distinct values and more typically includes hundreds of distinct values (e.g., at least 256). Intensity of a contact is, optionally, determined (or measured) using various approaches and various sensors or combinations of sensors. For

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example, one or more force sensors underneath or adjacent to the touch-sensitive surface are, optionally, used to measure force at various points on the touch-sensitive surface. In some implementations, force measurements from multiple force sensors are combined (e.g., a weighted average) to determine an estimated force of a contact. Similarly, a pressure-sensitive tip of a stylus is, optionally, used to determine a pressure of the stylus on the touch-sensitive surface. Alternatively, the size of the contact area detected on the touch-sensitive surface and/or changes thereto, the capacitance of the touch-sensitive surface proximate to the contact and/or changes thereto, and/or the resistance of the touch-sensitive surface proximate to the contact and/or changes thereto are, optionally, used as a substitute for the force or pressure of the contact on the touch-sensitive surface. In some implementations, the substitute measurements for contact force or pressure are used directly to determine whether an intensity threshold has been exceeded (e.g., the intensity threshold is described in units corresponding to the substitute measurements). In some implementations, the substitute measurements for contact force or pressure are converted to an estimated force or pressure and the estimated force or pressure is used to determine whether an intensity threshold has been exceeded (e.g., the intensity threshold is a pressure threshold measured in units of pressure).

[0054] As used in the specification and claims, the term "tactile output" refers to physical displacement of a device relative to a previous position of the device, physical displacement of a component (e.g., a touch-sensitive surface) of a device relative to another component (e.g., housing) of the device, or displacement of the component relative to a center of mass of the device that will be detected by a user with the user's sense of touch. For example, in situations where the device or the component of the device is in contact with a surface of a user that is sensitive to touch (e.g., a finger, palm, or other part of a user's hand), the tactile output generated by the physical displacement will be interpreted by the user as a tactile sensation corresponding to a perceived change in physical characteristics of the device or the component of the device. For example, movement of a touch-sensitive surface (e.g., a touch-sensitive display or trackpad) is, optionally, interpreted by the user as a "down click" or "up click" of a physical actuator button. In some cases, a user will feel a tactile sensation such as an "down click" or "up click" even when there is no movement of a physical actuator button associated with the touch-sensitive surface that is physically pressed (e.g., displaced) by the user's movements. As another example, movement of the touch-sensitive surface is, optionally, interpreted or sensed by the user as "roughness" of the touch-sensitive surface,

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even when there is no change in smoothness of the touch-sensitive surface. While such interpretations of touch by a user will be subject to the individualized sensory perceptions of the user, there are many sensory perceptions of touch that are common to a large majority of users. Thus, when a tactile output is described as corresponding to a particular sensory perception of a user (e.g., an "up click," a "down click," "roughness"), unless otherwise stated, the generated tactile output corresponds to physical displacement of the device or a component thereof that will generate the described sensory perception for a typical (or average) user.

[0055] It should be appreciated that device 100 is only one example of a portable multifunction device, and that device 100 optionally has more or fewer components than shown, optionally combines two or more components, or optionally has a different configuration or arrangement of the components. The various components shown in Figure 1A are implemented in hardware, software, or a combination of both hardware and software, including one or more signal processing and/or application specific integrated circuits.

[0056] Memory 102 optionally includes high-speed random access memory and optionally also includes non-volatile memory, such as one or more magnetic disk storage devices, flash memory devices, or other non-volatile solid-state memory devices. Access to memory 102 by other components of device 100, such as CPU 120 and the peripherals interface 118, is, optionally, controlled by memory controller 122.

[0057] Peripherals interface 118 can be used to couple input and output peripherals of the device to CPU 120 and memory 102. The one or more processors 120 run or execute various software programs and/or sets of instructions stored in memory 102 to perform various functions for device 100 and to process data.

[0058] In some embodiments, peripherals interface 118, CPU 120, and memory controller 122 are, optionally, implemented on a single chip, such as chip 104. In some other embodiments, they are, optionally, implemented on separate chips.

[0059] RF (radio frequency) circuitry 108 receives and sends RF signals, also called electromagnetic signals. RF circuitry 108 converts electrical signals to/from electromagnetic signals and communicates with communications networks and other communications devices via the electromagnetic signals. RF circuitry 108 optionally includes well-known circuitry for performing these functions, including but not limited to an antenna system, an RF transceiver, one or more amplifiers, a tuner, one or more oscillators, a digital signal processor, a CODEC

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chipset, a subscriber identity module (SIM) card, memory, and so forth. RF circuitry 108 optionally communicates with networks, such as the Internet, also referred to as the World Wide Web (WWW), an intranet and/or a wireless network, such as a cellular telephone network, a wireless local area network (LAN) and/or a metropolitan area network (MAN), and other devices by wireless communication. The wireless communication optionally uses any of a plurality of communications standards, protocols and technologies, including but not limited to Global System for Mobile Communications (GSM), Enhanced Data GSM Environment (EDGE), high-speed downlink packet access (HSDPA), high-speed uplink packet access (HSUPA), Evolution, Data-Only (EV-DO), HSPA, HSPA+, Dual-Cell HSPA (DC-HSPDA), long term evolution (LTE), near field communication (NFC), wideband code division multiple access (W-CDMA), code division multiple access (CDMA), time division multiple access (TDMA), Bluetooth, Wireless Fidelity (Wi-Fi) (e.g., IEEE 802.11a, IEEE 802.11b, IEEE 802.11g and/or IEEE 802.11n), voice over Internet Protocol (VoIP), Wi-MAX, a protocol for e-mail (e.g., Internet message access protocol (IMAP) and/or post office protocol (POP)), instant messaging (e.g., extensible messaging and presence protocol (XMPP), Session Initiation Protocol for Instant Messaging and Presence Leveraging Extensions (SIMPLE), Instant Messaging and Presence Service (IMPS)), and/or Short Message Service (SMS), or any other suitable communication protocol, including communication protocols not yet developed as of the filing date of this document.

[0060] Audio circuitry 110, speaker 111, and microphone 113 provide an audio interface between a user and device 100. Audio circuitry 110 receives audio data from peripherals interface 118, converts the audio data to an electrical signal, and transmits the electrical signal to speaker 111. Speaker 111 converts the electrical signal to human-audible sound waves. Audio circuitry 110 also receives electrical signals converted by microphone 113 from sound waves. Audio circuitry 110 converts the electrical signal to audio data and transmits the audio data to peripherals interface 118 for processing. Audio data is, optionally, retrieved from and/or transmitted to memory 102 and/or RF circuitry 108 by peripherals interface 118. In some embodiments, audio circuitry 110 also includes a headset jack (e.g., 212, Figure 2). The headset jack provides an interface between audio circuitry 110 and removable audio input/output peripherals, such as output-only headphones or a headset with both output (e.g., a headphone for one or both ears) and input (e.g., a microphone).

[0061] I/O subsystem 106 couples input/output peripherals on device 100, such as touch screen 112 and other input control devices 116, to peripherals interface 118. I/O

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subsystem 106 optionally includes display controller 156, optical sensor controller 158, intensity sensor controller 159, haptic feedback controller 161 and one or more input controllers 160 for other input or control devices. The one or more input controllers 160 receive/send electrical signals from/to other input or control devices 116. The other input control devices 116 optionally include physical buttons (e.g., push buttons, rocker buttons, etc.), dials, slider switches, joysticks, click wheels, and so forth. In some alternate embodiments, input controller(s) 160 are, optionally, coupled to any (or none) of the following: a keyboard, infrared port, USB port, and a pointer device such as a mouse. The one or more buttons (e.g., 208, Figure 2) optionally include an up/down button for volume control of speaker 111 and/or microphone 113. The one or more buttons optionally include a push button (e.g., 206, Figure 2).

[0062] Touch-sensitive display 112 provides an input interface and an output interface between the device and a user. Display controller 156 receives and/or sends electrical signals from/to touch screen 112. Touch screen 112 displays visual output to the user. The visual output optionally includes graphics, text, icons, video, and any combination thereof (collectively termed "graphics"). In some embodiments, some or all of the visual output corresponds to user-interface objects.

[0063] Touch screen 112 has a touch-sensitive surface, sensor or set of sensors that accepts input from the user based on haptic and/or tactile contact. Touch screen 112 and display controller 156 (along with any associated modules and/or sets of instructions in memory 102) detect contact (and any movement or breaking of the contact) on touch screen 112 and converts the detected contact into interaction with user-interface objects (e.g., one or more soft keys, icons, web pages or images) that are displayed on touch screen 112. In an exemplary embodiment, a point of contact between touch screen 112 and the user corresponds to a finger of the user.

[0064] Touch screen 112 optionally uses LCD (liquid crystal display) technology, LPD (light emitting polymer display) technology, or LED (light emitting diode) technology, although other display technologies are used in other embodiments. Touch screen 112 and display controller 156 optionally detect contact and any movement or breaking thereof using any of a plurality of touch sensing technologies now known or later developed, including but not limited to capacitive, resistive, infrared, and surface acoustic wave technologies, as well as other proximity sensor arrays or other elements for determining one or more points of contact with touch screen 112. In an exemplary embodiment, projected mutual capacitance

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sensing technology is used, such as that found in the iPhone®, iPod Touch®, and iPad® from Apple Inc. of Cupertino, California.

[0065] Touch screen 112 optionally has a video resolution in excess of 100 dpi. In some embodiments, the touch screen has a video resolution of approximately 160 dpi. The user optionally makes contact with touch screen 112 using any suitable object or appendage, such as a stylus, a finger, and so forth. In some embodiments, the user interface is designed to work primarily with finger-based contacts and gestures, which can be less precise than stylus-based input due to the larger area of contact of a finger on the touch screen. In some embodiments, the device translates the rough finger-based input into a precise pointer/cursor position or command for performing the actions desired by the user.

[0066] In some embodiments, in addition to the touch screen, device 100 optionally includes a touchpad (not shown) for activating or deactivating particular functions. In some embodiments, the touchpad is a touch-sensitive area of the device that, unlike the touch screen, does not display visual output. The touchpad is, optionally, a touch-sensitive surface that is separate from touch screen 112 or an extension of the touch-sensitive surface formed by the touch screen.

[0067] Device 100 also includes power system 162 for powering the various components. Power system 162 optionally includes a power management system, one or more power sources (e.g., battery, alternating current (AC)), a recharging system, a power failure detection circuit, a power converter or inverter, a power status indicator (e.g., a light-emitting diode (LED)) and any other components associated with the generation, management and distribution of power in portable devices.

[0068] Device 100 optionally also includes one or more optical sensors 164. Figure 1A shows an optical sensor coupled to optical sensor controller 158 in I/O subsystem 106. Optical sensor 164 optionally includes charge-coupled device (CCD) or complementary metal-oxide semiconductor (CMOS) phototransistors. Optical sensor 164 receives light from the environment, projected through one or more lens, and converts the light to data representing an image. In conjunction with imaging module 143 (also called a camera module), optical sensor 164 optionally captures still images or video. In some embodiments, an optical sensor is located on the back of device 100, opposite touch screen display 112 on the front of the device, so that the touch screen display is enabled for use as a viewfinder for still and/or video image acquisition. In some embodiments, another optical sensor is located

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on the front of the device so that the user's image is, optionally, obtained for videoconferencing while the user views the other video conference participants on the touch screen display.

[0069] Device 100 optionally also includes one or more contact intensity sensors 165. Figure 1A shows a contact intensity sensor coupled to intensity sensor controller 159 in I/O subsystem 106. Contact intensity sensor 165 optionally includes one or more piezoresistive strain gauges, capacitive force sensors, electric force sensors, piezoelectric force sensors, optical force sensors, capacitive touch-sensitive surfaces, or other intensity sensors (e.g., sensors used to measure the force (or pressure) of a contact on a touch-sensitive surface). Contact intensity sensor 165 receives contact intensity information (e.g., pressure information or a proxy for pressure information) from the environment. In some embodiments, at least one contact intensity sensor is collocated with, or proximate to, a touch-sensitive surface (e.g., touch-sensitive display system 112). In some embodiments, at least one contact intensity sensor is located on the back of device 100, opposite touch screen display 112 which is located on the front of device 100.

[0070] Device 100 optionally also includes one or more proximity sensors 166. Figure 1A shows proximity sensor 166 coupled to peripherals interface 118. Alternately, proximity sensor 166 is coupled to input controller 160 in I/O subsystem 106. In some embodiments, the proximity sensor turns off and disables touch screen 112 when the multifunction device is placed near the user's ear (e.g., when the user is making a phone call).

[0071] Device 100 optionally also includes one or more tactile output generators 167. Figure 1A shows a tactile output generator coupled to haptic feedback controller 161 in I/O subsystem 106. Tactile output generator 167 optionally includes one or more electroacoustic devices such as speakers or other audio components and/or electromechanical devices that convert energy into linear motion such as a motor, solenoid, electroactive polymer, piezoelectric actuator, electrostatic actuator, or other tactile output generating component (e.g., a component that converts electrical signals into tactile outputs on the device). Contact intensity sensor 165 receives tactile feedback generation instructions from haptic feedback module 133 and generates tactile outputs on device 100 that are capable of being sensed by a user of device 100. In some embodiments, at least one tactile output generator is collocated with, or proximate to, a touch-sensitive surface (e.g., touch-sensitive display system 112) and, optionally, generates a tactile output by moving the touch-sensitive surface vertically (e.g., in/out of a surface of device 100) or laterally (e.g., back and forth in the same plane as a

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surface of device 100). In some embodiments, at least one tactile output generator sensor is located on the back of device 100, opposite touch screen display 112 which is located on the front of device 100.

[0072] Device 100 optionally also includes one or more accelerometers 168. Figure 1A shows accelerometer 168 coupled to peripherals interface 118. Alternately, accelerometer 168 is, optionally, coupled to an input controller 160 in I/O subsystem 106. In some embodiments, information is displayed on the touch screen display in a portrait view or a landscape view based on an analysis of data received from the one or more accelerometers. Device 100 optionally includes, in addition to accelerometer(s) 168, a magnetometer (not shown) and a GPS (or GLONASS or other global navigation system) receiver (not shown) for obtaining information concerning the location and orientation (e.g., portrait or landscape) of device 100.

[0073] In some embodiments, the software components stored in memory 102 include operating system 126, communication module (or set of instructions) 128, contact/motion module (or set of instructions) 130, graphics module (or set of instructions) 132, text input module (or set of instructions) 134, Global Positioning System (GPS) module (or set of instructions) 135, and applications (or sets of instructions) 136. Furthermore, in some embodiments memory 102 stores device/global internal state 157, as shown in Figures 1A and 3. Device/global internal state 157 includes one or more of: active application state, indicating which applications, if any, are currently active; display state, indicating what applications, views or other information occupy various regions of touch screen display 112; sensor state, including information obtained from the device's various sensors and input control devices 116; and location information concerning the device's location and/or attitude.

[0074] Operating system 126 (e.g., Darwin, RTXC, LINUX, UNIX, OS X, WINDOWS, or an embedded operating system such as VxWorks) includes various software components and/or drivers for controlling and managing general system tasks (e.g., memory management, storage device control, power management, etc.) and facilitates communication between various hardware and software components.

[0075] Communication module 128 facilitates communication with other devices over one or more external ports 124 and also includes various software components for handling data received by RF circuitry 108 and/or external port 124. External port 124 (e.g.,

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Universal Serial Bus (USB), FIREWIRE, etc.) is adapted for coupling directly to other devices or indirectly over a network (e.g., the Internet, wireless LAN, etc.). In some embodiments, the external port is a multi-pin (e.g., 30-pin) connector that is the same as, or similar to and/or compatible with the 30-pin connector used on iPod (trademark of Apple Inc.) devices.

[0076] Contact/motion module 130 optionally detects contact with touch screen 112 (in conjunction with display controller 156) and other touch sensitive devices (e.g., a touchpad or physical click wheel). Contact/motion module 130 includes various software components for performing various operations related to detection of contact, such as determining if contact has occurred (e.g., detecting a finger-down event), determining an intensity of the contact (e.g., the force or pressure of the contact or a substitute for the force or pressure of the contact) determining if there is movement of the contact and tracking the movement across the touch-sensitive surface (e.g., detecting one or more finger-dragging events), and determining if the contact has ceased (e.g., detecting a finger-up event or a break in contact). Contact/motion module 130 receives contact data from the touch-sensitive surface. Determining movement of the point of contact, which is represented by a series of contact data, optionally includes determining speed (magnitude), velocity (magnitude and direction), and/or an acceleration (a change in magnitude and/or direction) of the point of contact. These operations are, optionally, applied to single contacts (e.g., one finger contacts) or to multiple simultaneous contacts (e.g., "multitouch"/multiple finger contacts). In some embodiments, contact/motion module 130 and display controller 156 detect contact on a touchpad.

[0077] In some embodiments, contact/motion module 130 uses a set of one or more intensity thresholds to determine whether an operation has been performed by a user (e.g., to determine whether a user has “clicked” on an icon). In some embodiments at least a subset of the intensity thresholds are determined in accordance with software parameters (e.g., the intensity thresholds are not determined by the activation thresholds of particular physical actuators and can be adjusted without changing the physical hardware of device 100). For example, a mouse “click” threshold of a trackpad or touch screen display can be set to any of a large range of predefined thresholds values without changing the trackpad or touch screen display hardware. Additionally, in some implementations a user of the device is provided with software settings for adjusting one or more of the set of intensity thresholds (e.g., by

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adjusting individual intensity thresholds and/or by adjusting a plurality of intensity thresholds at once with a system-level click "intensity" parameter).

[0078] Contact/motion module 130 optionally detects a gesture input by a user. Different gestures on the touch-sensitive surface have different contact patterns and intensities. Thus, a gesture is, optionally, detected by detecting a particular contact pattern. For example, detecting a finger tap gesture includes detecting a finger-down event followed by detecting a finger-up (lift off) event at the same position (or substantially the same position) as the finger-down event (e.g., at the position of an icon). As another example, detecting a finger swipe gesture on the touch-sensitive surface includes detecting a finger-down event followed by detecting one or more finger-dragging events, and subsequently followed by detecting a finger-up (lift off) event.

[0079] Graphics module 132 includes various known software components for rendering and displaying graphics on touch screen 112 or other display, including components for changing the visual impact (e.g., brightness, transparency, saturation, contrast or other visual property) of graphics that are displayed. As used herein, the term "graphics" includes any object that can be displayed to a user, including without limitation text, web pages, icons (such as user-interface objects including soft keys), digital images, videos, animations and the like.

[0080] In some embodiments, graphics module 132 stores data representing graphics to be used. Each graphic is, optionally, assigned a corresponding code. Graphics module 132 receives, from applications etc., one or more codes specifying graphics to be displayed along with, if necessary, coordinate data and other graphic property data, and then generates screen image data to output to display controller 156.

[0081] Haptic feedback module 133 includes various software components for generating instructions used by tactile output generator(s) 167 to produce tactile outputs at one or more locations on device 100 in response to user interactions with device 100.

[0082] Text input module 134, which is, optionally, a component of graphics module 132, provides soft keyboards for entering text in various applications (e.g., contacts 137, e-mail 140, IM 141, browser 147, and any other application that needs text input).

[0083] GPS module 135 determines the location of the device and provides this information for use in various applications (e.g., to telephone 138 for use in location-based dialing, to camera 143 as picture/video metadata, and to applications that provide location-

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based services such as weather widgets, local yellow page widgets, and map/navigation widgets).

[0084] Applications 136 optionally include the following modules (or sets of instructions), or a subset or superset thereof:

- contacts module 137 (sometimes called an address book or contact list);
- telephone module 138;
- video conferencing module 139;
- e-mail client module 140;
- instant messaging (IM) module 141;
- workout support module 142;
- camera module 143 for still and/or video images;
- image management module 144;
- browser module 147;
- calendar module 148;
- widget modules 149, which optionally include one or more of: weather widget 149-1, stocks widget 149-2, calculator widget 149-3, alarm clock widget 149-4, dictionary widget 149-5, and other widgets obtained by the user, as well as user-created widgets 149-6;
- widget creator module 150 for making user-created widgets 149-6;
- search module 151;
- video and music player module 152, which is, optionally, made up of a video player module and a music player module;
- notes module 153;
- map module 154; and/or
- online video module 155.

[0085] Examples of other applications 136 that are, optionally, stored in memory 102 include other word processing applications, other image editing applications, drawing

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applications, presentation applications, JAVA-enabled applications, encryption, digital rights management, voice recognition, and voice replication.

[0086] In conjunction with touch screen 112, display controller 156, contact module 130, graphics module 132, and text input module 134, contacts module 137 are, optionally, used to manage an address book or contact list (e.g., stored in application internal state 192 of contacts module 137 in memory 102 or memory 370), including: adding name(s) to the address book; deleting name(s) from the address book; associating telephone number(s), e-mail address(es), physical address(es) or other information with a name; associating an image with a name; categorizing and sorting names; providing telephone numbers or e-mail addresses to initiate and/or facilitate communications by telephone 138, video conference 139, e-mail 140, or IM 141; and so forth.

[0087] In conjunction with RF circuitry 108, audio circuitry 110, speaker 111, microphone 113, touch screen 112, display controller 156, contact module 130, graphics module 132, and text input module 134, telephone module 138 are, optionally, used to enter a sequence of characters corresponding to a telephone number, access one or more telephone numbers in address book 137, modify a telephone number that has been entered, dial a respective telephone number, conduct a conversation and disconnect or hang up when the conversation is completed. As noted above, the wireless communication optionally uses any of a plurality of communications standards, protocols and technologies.

[0088] In conjunction with RF circuitry 108, audio circuitry 110, speaker 111, microphone 113, touch screen 112, display controller 156, optical sensor 164, optical sensor controller 158, contact module 130, graphics module 132, text input module 134, contact list 137, and telephone module 138, videoconferencing module 139 includes executable instructions to initiate, conduct, and terminate a video conference between a user and one or more other participants in accordance with user instructions.

[0089] In conjunction with RF circuitry 108, touch screen 112, display controller 156, contact module 130, graphics module 132, and text input module 134, e-mail client module 140 includes executable instructions to create, send, receive, and manage e-mail in response to user instructions. In conjunction with image management module 144, e-mail client module 140 makes it very easy to create and send e-mails with still or video images taken with camera module 143.

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[0090] In conjunction with RF circuitry 108, touch screen 112, display controller 156, contact module 130, graphics module 132, and text input module 134, the instant messaging module 141 includes executable instructions to enter a sequence of characters corresponding to an instant message, to modify previously entered characters, to transmit a respective instant message (for example, using a Short Message Service (SMS) or Multimedia Message Service (MMS) protocol for telephony-based instant messages or using XMPP, SIMPLE, or IMPS for Internet-based instant messages), to receive instant messages and to view received instant messages. In some embodiments, transmitted and/or received instant messages optionally include graphics, photos, audio files, video files and/or other attachments as are supported in a MMS and/or an Enhanced Messaging Service (EMS). As used herein, "instant messaging" refers to both telephony-based messages (e.g., messages sent using SMS or MMS) and Internet-based messages (e.g., messages sent using XMPP, SIMPLE, or IMPS).

[0091] In conjunction with RF circuitry 108, touch screen 112, display controller 156, contact module 130, graphics module 132, text input module 134, GPS module 135, map module 154, and music player module 146, workout support module 142 includes executable instructions to create workouts (e.g., with time, distance, and/or calorie burning goals); communicate with workout sensors (sports devices); receive workout sensor data; calibrate sensors used to monitor a workout; select and play music for a workout; and display, store and transmit workout data.

[0092] In conjunction with touch screen 112, display controller 156, optical sensor(s) 164, optical sensor controller 158, contact module 130, graphics module 132, and image management module 144, camera module 143 includes executable instructions to capture still images or video (including a video stream) and store them into memory 102, modify characteristics of a still image or video, or delete a still image or video from memory 102.

[0093] In conjunction with touch screen 112, display controller 156, contact module 130, graphics module 132, text input module 134, and camera module 143, image management module 144 includes executable instructions to arrange, modify (e.g., edit), or otherwise manipulate, label, delete, present (e.g., in a digital slide show or album), and store still and/or video images.

[0094] In conjunction with RF circuitry 108, touch screen 112, display system controller 156, contact module 130, graphics module 132, and text input module 134, browser module 147 includes executable instructions to browse the Internet in accordance

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with user instructions, including searching, linking to, receiving, and displaying web pages or portions thereof, as well as attachments and other files linked to web pages.

[0095] In conjunction with RF circuitry 108, touch screen 112, display system controller 156, contact module 130, graphics module 132, text input module 134, e-mail client module 140, and browser module 147, calendar module 148 includes executable instructions to create, display, modify, and store calendars and data associated with calendars (e.g., calendar entries, to do lists, etc.) in accordance with user instructions.

[0096] In conjunction with RF circuitry 108, touch screen 112, display system controller 156, contact module 130, graphics module 132, text input module 134, and browser module 147, widget modules 149 are mini-applications that are, optionally, downloaded and used by a user (e.g., weather widget 149-1, stocks widget 149-2, calculator widget 149-3, alarm clock widget 149-4, and dictionary widget 149-5) or created by the user (e.g., user-created widget 149-6). In some embodiments, a widget includes an HTML (Hypertext Markup Language) file, a CSS (Cascading Style Sheets) file, and a JavaScript file. In some embodiments, a widget includes an XML (Extensible Markup Language) file and a JavaScript file (e.g., Yahoo! Widgets).

[0097] In conjunction with RF circuitry 108, touch screen 112, display system controller 156, contact module 130, graphics module 132, text input module 134, and browser module 147, the widget creator module 150 are, optionally, used by a user to create widgets (e.g., turning a user-specified portion of a web page into a widget).

[0098] In conjunction with touch screen 112, display system controller 156, contact module 130, graphics module 132, and text input module 134, search module 151 includes executable instructions to search for text, music, sound, image, video, and/or other files in memory 102 that match one or more search criteria (e.g., one or more user-specified search terms) in accordance with user instructions.

[0099] In conjunction with touch screen 112, display system controller 156, contact module 130, graphics module 132, audio circuitry 110, speaker 111, RF circuitry 108, and browser module 147, video and music player module 152 includes executable instructions that allow the user to download and play back recorded music and other sound files stored in one or more file formats, such as MP3 or AAC files, and executable instructions to display, present or otherwise play back videos (e.g., on touch screen 112 or on an external, connected

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display via external port 124). In some embodiments, device 100 optionally includes the functionality of an MP3 player, such as an iPod (trademark of Apple Inc.).

[00100] In conjunction with touch screen 112, display controller 156, contact module 130, graphics module 132, and text input module 134, notes module 153 includes executable instructions to create and manage notes, to do lists, and the like in accordance with user instructions.

[00101] In conjunction with RF circuitry 108, touch screen 112, display system controller 156, contact module 130, graphics module 132, text input module 134, GPS module 135, and browser module 147, map module 154 are, optionally, used to receive, display, modify, and store maps and data associated with maps (e.g., driving directions; data on stores and other points of interest at or near a particular location; and other location-based data) in accordance with user instructions.

[00102] In conjunction with touch screen 112, display system controller 156, contact module 130, graphics module 132, audio circuitry 110, speaker 111, RF circuitry 108, text input module 134, e-mail client module 140, and browser module 147, online video module 155 includes instructions that allow the user to access, browse, receive (e.g., by streaming and/or download), play back (e.g., on the touch screen or on an external, connected display via external port 124), send an e-mail with a link to a particular online video, and otherwise manage online videos in one or more file formats, such as H.264. In some embodiments, instant messaging module 141, rather than e-mail client module 140, is used to send a link to a particular online video.

[00103] Each of the above identified modules and applications correspond to a set of executable instructions for performing one or more functions described above and the methods described in this application (e.g., the computer-implemented methods and other information processing methods described herein). These modules (i.e., sets of instructions) need not be implemented as separate software programs, procedures or modules, and thus various subsets of these modules are, optionally, combined or otherwise re-arranged in various embodiments. In some embodiments, memory 102 optionally stores a subset of the modules and data structures identified above. Furthermore, memory 102 optionally stores additional modules and data structures not described above.

[00104] In some embodiments, device 100 is a device where operation of a predefined set of functions on the device is performed exclusively through a touch screen and/or a

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touchpad. By using a touch screen and/or a touchpad as the primary input control device for operation of device 100, the number of physical input control devices (such as push buttons, dials, and the like) on device 100 is, optionally, reduced.

[00105] The predefined set of functions that are performed exclusively through a touch screen and/or a touchpad optionally include navigation between user interfaces. In some embodiments, the touchpad, when touched by the user, navigates device 100 to a main, home, or root menu from any user interface that is displayed on device 100. In such embodiments, a "menu button" is implemented using a touchpad. In some other embodiments, the menu button is a physical push button or other physical input control device instead of a touchpad.

[00106] Figure 1B is a block diagram illustrating exemplary components for event handling in accordance with some embodiments. In some embodiments, memory 102 (in Figures 1A) or 370 (Figure 3) includes event sorter 170 (e.g., in operating system 126) and a respective application 136-1 (e.g., any of the aforementioned applications 137-151, 155, 380-390).

[00107] Event sorter 170 receives event information and determines the application 136-1 and application view 191 of application 136-1 to which to deliver the event information. Event sorter 170 includes event monitor 171 and event dispatcher module 174. In some embodiments, application 136-1 includes application internal state 192, which indicates the current application view(s) displayed on touch sensitive display 112 when the application is active or executing. In some embodiments, device/global internal state 157 is used by event sorter 170 to determine which application(s) is (are) currently active, and application internal state 192 is used by event sorter 170 to determine application views 191 to which to deliver event information.

[00108] In some embodiments, application internal state 192 includes additional information, such as one or more of: resume information to be used when application 136-1 resumes execution, user interface state information that indicates information being displayed or that is ready for display by application 136-1, a state queue for enabling the user to go back to a prior state or view of application 136-1, and a redo/undo queue of previous actions taken by the user.

[00109] Event monitor 171 receives event information from peripherals interface 118. Event information includes information about a sub-event (e.g., a user touch on touch-sensitive display 112, as part of a multi-touch gesture). Peripherals interface 118 transmits

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information it receives from I/O subsystem 106 or a sensor, such as proximity sensor 166, accelerometer(s) 168, and/or microphone 113 (through audio circuitry 110). Information that peripherals interface 118 receives from I/O subsystem 106 includes information from touch-sensitive display 112 or a touch-sensitive surface.

[00110] In some embodiments, event monitor 171 sends requests to the peripherals interface 118 at predetermined intervals. In response, peripherals interface 118 transmits event information. In other embodiments, peripheral interface 118 transmits event information only when there is a significant event (e.g., receiving an input above a predetermined noise threshold and/or for more than a predetermined duration).

[00111] In some embodiments, event sorter 170 also includes a hit view determination module 172 and/or an active event recognizer determination module 173.

[00112] Hit view determination module 172 provides software procedures for determining where a sub-event has taken place within one or more views, when touch sensitive display 112 displays more than one view. Views are made up of controls and other elements that a user can see on the display.

[00113] Another aspect of the user interface associated with an application is a set of views, sometimes herein called application views or user interface windows, in which information is displayed and touch-based gestures occur. The application views (of a respective application) in which a touch is detected optionally correspond to programmatic levels within a programmatic or view hierarchy of the application. For example, the lowest level view in which a touch is detected is, optionally, called the hit view, and the set of events that are recognized as proper inputs are, optionally, determined based, at least in part, on the hit view of the initial touch that begins a touch-based gesture.

[00114] Hit view determination module 172 receives information related to sub-events of a touch-based gesture. When an application has multiple views organized in a hierarchy, hit view determination module 172 identifies a hit view as the lowest view in the hierarchy which should handle the sub-event. In most circumstances, the hit view is the lowest level view in which an initiating sub-event occurs (i.e., the first sub-event in the sequence of sub-events that form an event or potential event). Once the hit view is identified by the hit view determination module, the hit view typically receives all sub-events related to the same touch or input source for which it was identified as the hit view.

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[00115] Active event recognizer determination module 173 determines which view or views within a view hierarchy should receive a particular sequence of sub-events. In some embodiments, active event recognizer determination module 173 determines that only the hit view should receive a particular sequence of sub-events. In other embodiments, active event recognizer determination module 173 determines that all views that include the physical location of a sub-event are actively involved views, and therefore determines that all actively involved views should receive a particular sequence of sub-events. In other embodiments, even if touch sub-events were entirely confined to the area associated with one particular view, views higher in the hierarchy would still remain as actively involved views.

[00116] Event dispatcher module 174 dispatches the event information to an event recognizer (e.g., event recognizer 180). In embodiments including active event recognizer determination module 173, event dispatcher module 174 delivers the event information to an event recognizer determined by active event recognizer determination module 173. In some embodiments, event dispatcher module 174 stores in an event queue the event information, which is retrieved by a respective event receiver module 182.

[00117] In some embodiments, operating system 126 includes event sorter 170. Alternatively, application 136-1 includes event sorter 170. In yet other embodiments, event sorter 170 is a stand-alone module, or a part of another module stored in memory 102, such as contact/motion module 130.

[00118] In some embodiments, application 136-1 includes a plurality of event handlers 190 and one or more application views 191, each of which includes instructions for handling touch events that occur within a respective view of the application's user interface. Each application view 191 of the application 136-1 includes one or more event recognizers 180. Typically, a respective application view 191 includes a plurality of event recognizers 180. In other embodiments, one or more of event recognizers 180 are part of a separate module, such as a user interface kit (not shown) or a higher level object from which application 136-1 inherits methods and other properties. In some embodiments, a respective event handler 190 includes one or more of: data updater 176, object updater 177, GUI updater 178, and/or event data 179 received from event sorter 170. Event handler 190 optionally utilizes or calls data updater 176, object updater 177 or GUI updater 178 to update the application internal state 192. Alternatively, one or more of the application views 191 includes one or more respective event handlers 190. Also, in some embodiments, one or more of data updater 176, object updater 177, and GUI updater 178 are included in a respective application view 191.

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[00119] A respective event recognizer 180 receives event information (e.g., event data 179) from event sorter 170, and identifies an event from the event information. Event recognizer 180 includes event receiver 182 and event comparator 184. In some embodiments, event recognizer 180 also includes at least a subset of: metadata 183, and event delivery instructions 188 (which optionally include sub-event delivery instructions).

[00120] Event receiver 182 receives event information from event sorter 170. The event information includes information about a sub-event, for example, a touch or a touch movement. Depending on the sub-event, the event information also includes additional information, such as location of the sub-event. When the sub-event concerns motion of a touch, the event information optionally also includes speed and direction of the sub-event. In some embodiments, events include rotation of the device from one orientation to another (e.g., from a portrait orientation to a landscape orientation, or vice versa), and the event information includes corresponding information about the current orientation (also called device attitude) of the device.

[00121] Event comparator 184 compares the event information to predefined event or sub-event definitions and, based on the comparison, determines an event or sub-event, or determines or updates the state of an event or sub-event. In some embodiments, event comparator 184 includes event definitions 186. Event definitions 186 contain definitions of events (e.g., predefined sequences of sub-events), for example, event 1 (187-1), event 2 (187-2), and others. In some embodiments, sub-events in an event 187 include, for example, touch begin, touch end, touch movement, touch cancellation, and multiple touching. In one example, the definition for event 1 (187-1) is a double tap on a displayed object. The double tap, for example, comprises a first touch (touch begin) on the displayed object for a predetermined phase, a first lift-off (touch end) for a predetermined phase, a second touch (touch begin) on the displayed object for a predetermined phase, and a second lift-off (touch end) for a predetermined phase. In another example, the definition for event 2 (187-2) is a dragging on a displayed object. The dragging, for example, comprises a touch (or contact) on the displayed object for a predetermined phase, a movement of the touch across touch-sensitive display 112, and lift-off of the touch (touch end). In some embodiments, the event also includes information for one or more associated event handlers 190.

[00122] In some embodiments, event definition 187 includes a definition of an event for a respective user-interface object. In some embodiments, event comparator 184 performs a hit test to determine which user-interface object is associated with a sub-event. For

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example, in an application view in which three user-interface objects are displayed on touch-sensitive display 112, when a touch is detected on touch-sensitive display 112, event comparator 184 performs a hit test to determine which of the three user-interface objects is associated with the touch (sub-event). If each displayed object is associated with a respective event handler 190, the event comparator uses the result of the hit test to determine which event handler 190 should be activated. For example, event comparator 184 selects an event handler associated with the sub-event and the object triggering the hit test.

[00123] In some embodiments, the definition for a respective event 187 also includes delayed actions that delay delivery of the event information until after it has been determined whether the sequence of sub-events does or does not correspond to the event recognizer's event type.

[00124] When a respective event recognizer 180 determines that the series of sub-events do not match any of the events in event definitions 186, the respective event recognizer 180 enters an event impossible, event failed, or event ended state, after which it disregards subsequent sub-events of the touch-based gesture. In this situation, other event recognizers, if any, that remain active for the hit view continue to track and process sub-events of an ongoing touch-based gesture.

[00125] In some embodiments, a respective event recognizer 180 includes metadata 183 with configurable properties, flags, and/or lists that indicate how the event delivery system should perform sub-event delivery to actively involved event recognizers. In some embodiments, metadata 183 includes configurable properties, flags, and/or lists that indicate how event recognizers interact, or are enabled to interact, with one another. In some embodiments, metadata 183 includes configurable properties, flags, and/or lists that indicate whether sub-events are delivered to varying levels in the view or programmatic hierarchy.

[00126] In some embodiments, a respective event recognizer 180 activates event handler 190 associated with an event when one or more particular sub-events of an event are recognized. In some embodiments, a respective event recognizer 180 delivers event information associated with the event to event handler 190. Activating an event handler 190 is distinct from sending (and deferred sending) sub-events to a respective hit view. In some embodiments, event recognizer 180 throws a flag associated with the recognized event, and event handler 190 associated with the flag catches the flag and performs a predefined process.

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[00127] In some embodiments, event delivery instructions 188 include sub-event delivery instructions that deliver event information about a sub-event without activating an event handler. Instead, the sub-event delivery instructions deliver event information to event handlers associated with the series of sub-events or to actively involved views. Event handlers associated with the series of sub-events or with actively involved views receive the event information and perform a predetermined process.

[00128] In some embodiments, data updater 176 creates and updates data used in application 136-1. For example, data updater 176 updates the telephone number used in contacts module 137, or stores a video file used in video player module 145. In some embodiments, object updater 177 creates and updates objects used in application 136-1. For example, object updater 176 creates a new user-interface object or updates the position of a user-interface object. GUI updater 178 updates the GUI. For example, GUI updater 178 prepares display information and sends it to graphics module 132 for display on a touch-sensitive display.

[00129] In some embodiments, event handler(s) 190 includes or has access to data updater 176, object updater 177, and GUI updater 178. In some embodiments, data updater 176, object updater 177, and GUI updater 178 are included in a single module of a respective application 136-1 or application view 191. In other embodiments, they are included in two or more software modules.

[00130] It shall be understood that the foregoing discussion regarding event handling of user touches on touch-sensitive displays also applies to other forms of user inputs to operate multifunction devices 100 with input-devices, not all of which are initiated on touch screens. For example, mouse movement and mouse button presses, optionally coordinated with single or multiple keyboard presses or holds; contact movements such as taps, drags, scrolls, etc., on touch-pads; pen stylus inputs; movement of the device; oral instructions; detected eye movements; biometric inputs; and/or any combination thereof are optionally utilized as inputs corresponding to sub-events which define an event to be recognized.

[00131] Figure 2 illustrates a portable multifunction device 100 having a touch screen 112 in accordance with some embodiments. The touch screen optionally displays one or more graphics within user interface (UI) 200. In this embodiment, as well as others described below, a user is enabled to select one or more of the graphics by making a gesture on the graphics, for example, with one or more fingers 202 (not drawn to scale in the figure) or one

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or more styluses 203 (not drawn to scale in the figure). In some embodiments, selection of one or more graphics occurs when the user breaks contact with the one or more graphics. In some embodiments, the gesture optionally includes one or more taps, one or more swipes (from left to right, right to left, upward and/or downward) and/or a rolling of a finger (from right to left, left to right, upward and/or downward) that has made contact with device 100. In some implementations or circumstances, inadvertent contact with a graphic does not select the graphic. For example, a swipe gesture that sweeps over an application icon optionally does not select the corresponding application when the gesture corresponding to selection is a tap.

[00132] Device 100 optionally also includes one or more physical buttons, such as "home" or menu button 204. As described previously, menu button 204 is, optionally, used to navigate to any application 136 in a set of applications that are, optionally executed on device 100. Alternatively, in some embodiments, the menu button is implemented as a soft key in a GUI displayed on touch screen 112.

[00133] In one embodiment, device 100 includes touch screen 112, menu button 204, push button 206 for powering the device on/off and locking the device, volume adjustment button(s) 208, Subscriber Identity Module (SIM) card slot 210, head set jack 212, and docking/charging external port 124. Push button 206 is, optionally, used to turn the power on/off on the device by depressing the button and holding the button in the depressed state for a predefined time interval; to lock the device by depressing the button and releasing the button before the predefined time interval has elapsed; and/or to unlock the device or initiate an unlock process. In an alternative embodiment, device 100 also accepts verbal input for activation or deactivation of some functions through microphone 113. Device 100 also, optionally, includes one or more contact intensity sensors 165 for detecting intensity of contacts on touch screen 112 and/or one or more tactile output generators 167 for generating tactile outputs for a user of device 100.

[00134] Figure 3 is a block diagram of an exemplary multifunction device with a display and a touch-sensitive surface in accordance with some embodiments. Device 300 need not be portable. In some embodiments, device 300 is a laptop computer, a desktop computer, a tablet computer, a multimedia player device, a navigation device, an educational device (such as a child's learning toy), a gaming system, or a control device (e.g., a home or industrial controller). Device 300 typically includes one or more processing units (CPU's) 310, one or more network or other communications interfaces 360, memory 370, and one or

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more communication buses 320 for interconnecting these components. Communication buses 320 optionally include circuitry (sometimes called a chipset) that interconnects and controls communications between system components. Device 300 includes input/output (I/O) interface 330 comprising display 340, which is typically a touch screen display. I/O interface 330 also optionally includes a keyboard and/or mouse (or other pointing device) 350 and touchpad 355, tactile output generator 357 for generating tactile outputs on device 300 (e.g., similar to tactile output generator(s) 167 described above with reference to Figure 1A), sensors 359 (e.g., optical, acceleration, proximity, touch-sensitive, and/or contact intensity sensors similar to contact intensity sensor(s) 165 described above with reference to Figure 1A). Memory 370 includes high-speed random access memory, such as DRAM, SRAM, DDR RAM or other random access solid state memory devices; and optionally includes non-volatile memory, such as one or more magnetic disk storage devices, optical disk storage devices, flash memory devices, or other non-volatile solid state storage devices. Memory 370 optionally includes one or more storage devices remotely located from CPU(s) 310. In some embodiments, memory 370 stores programs, modules, and data structures analogous to the programs, modules, and data structures stored in memory 102 of portable multifunction device 100 (Figure 1A), or a subset thereof. Furthermore, memory 370 optionally stores additional programs, modules, and data structures not present in memory 102 of portable multifunction device 100. For example, memory 370 of device 300 optionally stores drawing module 380, presentation module 382, word processing module 384, website creation module 386, disk authoring module 388, and/or spreadsheet module 390, while memory 102 of portable multifunction device 100 (Figure 1A) optionally does not store these modules.

[00135] Each of the above identified elements in Figure 3 are, optionally, stored in one or more of the previously mentioned memory devices. Each of the above identified modules corresponds to a set of instructions for performing a function described above. The above identified modules or programs (i.e., sets of instructions) need not be implemented as separate software programs, procedures or modules, and thus various subsets of these modules are, optionally, combined or otherwise re-arranged in various embodiments. In some embodiments, memory 370 optionally stores a subset of the modules and data structures identified above. Furthermore, memory 370 optionally stores additional modules and data structures not described above.

[00136] Attention is now directed towards embodiments of user interfaces ("UI") that is, optionally, implemented on portable multifunction device 100.

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[00137] Figure 4A illustrates an exemplary user interface for a menu of applications on portable multifunction device 100 in accordance with some embodiments. Similar user interfaces are, optionally, implemented on device 300. In some embodiments, user interface 400 includes the following elements, or a subset or superset thereof:

- Signal strength indicator(s) 402 for wireless communication(s), such as cellular and Wi-Fi signals;
- Time 404;
- Bluetooth indicator 405;
- Battery status indicator 406;
- Tray 408 with icons for frequently used applications, such as:
    - Icon 416 for telephone module 138, labeled "Phone," which optionally includes an indicator 414 of the number of missed calls or voicemail messages;
    - Icon 418 for e-mail client module 140, labeled "Mail," which optionally includes an indicator 410 of the number of unread e-mails;
    - Icon 420 for browser module 147, labeled "Browser;" and
    - Icon 422 for video and music player module 152, also referred to as iPod (trademark of Apple Inc.) module 152, labeled "iPod;" and
- Icons for other applications, such as:
    - Icon 424 for IM module 141, labeled "Text;"
    - Icon 426 for calendar module 148, labeled "Calendar;"
    - Icon 428 for image management module 144, labeled "Photos;"
    - Icon 430 for camera module 143, labeled "Camera;"
    - Icon 432 for online video module 155, labeled "Online Video"
    - Icon 434 for stocks widget 149-2, labeled "Stocks;"
    - Icon 436 for map module 154, labeled "Map;"
    - Icon 438 for weather widget 149-1, labeled "Weather;"
    - Icon 440 for alarm clock widget 149-4, labeled "Clock;"

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- Icon 442 for workout support module 142, labeled "Workout Support;"
- Icon 444 for notes module 153, labeled "Notes;" and
- Icon 446 for a settings application or module, which provides access to settings for device 100 and its various applications 136.

[00138] It should be noted that the icon labels illustrated in Figure 4A are merely exemplary. For example, icon 422 for video and music player module 152 are labeled "Music" or "Music Player." Other labels are, optionally, used for various application icons. In some embodiments, a label for a respective application icon includes a name of an application corresponding to the respective application icon. In some embodiments, a label for a particular application icon is distinct from a name of an application corresponding to the particular application icon.

[00139] Figure 4B illustrates an exemplary user interface on a device (e.g., device 300, Figure 3) with a touch-sensitive surface 451 (e.g., a tablet or touchpad 355, Figure 3) that is separate from the display 450 (e.g., touch screen display 112). Device 300 also, optionally, includes one or more contact intensity sensors (e.g., one or more of sensors 357) for detecting intensity of contacts on touch-sensitive surface 451 and/or one or more tactile output generators 359 for generating tactile outputs for a user of device 300.

[00140] Although some of the examples which follow will be given with reference to inputs on touch screen display 112 (where the touch sensitive surface and the display are combined), in some embodiments, the device detects inputs on a touch-sensitive surface that is separate from the display, as shown in Figure 4B. In some embodiments the touch sensitive surface (e.g., 451 in Figure 4B) has a primary axis (e.g., 452 in Figure 4B) that corresponds to a primary axis (e.g., 453 in Figure 4B) on the display (e.g., 450). In accordance with these embodiments, the device detects contacts (e.g., 460 and 462 in Figure 4B) with the touch-sensitive surface 451 at locations that correspond to respective locations on the display (e.g., in Figure 4B, 460 corresponds to 468 and 462 corresponds to 470). In this way, user inputs (e.g., contacts 460 and 462, and movements thereof) detected by the device on the touch-sensitive surface (e.g., 451 in Figure 4B) are used by the device to manipulate the user interface on the display (e.g., 450 in Figure 4B) of the multifunction device when the touch-sensitive surface is separate from the display. It should be understood that similar methods are, optionally, used for other user interfaces described herein.

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[00141] Additionally, while the following examples are given primarily with reference to finger inputs (e.g., finger contacts, finger tap gestures, finger swipe gestures), it should be understood that, in some embodiments, one or more of the finger inputs are replaced with input from another input device (e.g., a mouse based input or stylus input). For example, a swipe gesture is, optionally, replaced with a mouse click (e.g., instead of a contact) followed by movement of the cursor along the path of the swipe (e.g., instead of movement of the contact). As another example, a tap gesture is, optionally, replaced with a mouse click while the cursor is located over the location of the tap gesture (e.g., instead of detection of the contact followed by ceasing to detect the contact). Similarly, when multiple user inputs are simultaneously detected, it should be understood that multiple computer mice are, optionally, used simultaneously, or a mouse and finger contacts are, optionally, used simultaneously.

[00142] As used herein, the term "focus selector" refers to an input element that indicates a current part of a user interface with which a user is interacting. In some implementations that include a cursor or other location marker, the cursor acts as a "focus selector," so that when an input (e.g., a press input) is detected on a touch-sensitive surface (e.g., touchpad 355 in Figure 3 or touch-sensitive surface 451 in Figure 4B) while the cursor is over a particular user interface element (e.g., a button, window, slider or other user interface element), the particular user interface element is adjusted in accordance with the detected input. In some implementations that include a touch-screen display (e.g., touch-sensitive display system 112 in Figure 1A or touch screen 112 in Figure 4A) that enables direct interaction with user interface elements on the touch-screen display, a detected contact on the touch-screen acts as a "focus selector," so that when an input (e.g., a press input by the contact) is detected on the touch-screen display at a location of a particular user interface element (e.g., a button, window, slider or other user interface element), the particular user interface element is adjusted in accordance with the detected input. In some implementations focus is moved from one region of a user interface to another region of the user interface without corresponding movement of a cursor or movement of a contact on a touch-screen display (e.g., by using a tab key or arrow keys to move focus from one button to another button); in these implementations, the focus selector moves in accordance with movement of focus between different regions of the user interface. Without regard to the specific form taken by the focus selector, the focus selector is generally the user interface element (or contact on a touch-screen display) that is controlled by the user so as to communicate the user's intended interaction with the user interface (e.g., by indicating, to the device, the

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element of the user interface with which the user is intending to interact). For example, the location of a focus selector (e.g., a cursor, a contact or a selection box) over a respective button while a press input is detected on the touch-sensitive surface (e.g., a touchpad or touch screen) will indicate that the user is intending to activate the respective button (as opposed to other user interface elements shown on a display of the device).

[00143] The user interface figures described below include various intensity diagrams that show the current intensity of the contact on the touch-sensitive surface relative to one or more intensity thresholds (e.g., a contact detection intensity threshold IT_0, a light press intensity threshold IT_L, a deep press intensity threshold IT_D, and/or one or more other intensity thresholds). This intensity diagram is typically not part of the displayed user interface, but is provided to aid in the interpretation of the figures. In some embodiments, the light press intensity threshold corresponds to an intensity at which the device will perform operations typically associated with clicking a button of a physical mouse or a trackpad. In some embodiments, the deep press intensity threshold corresponds to an intensity at which the device will perform operations that are different from operations typically associated with clicking a button of a physical mouse or a trackpad. In some embodiments, when a contact is detected with an intensity below the light press intensity threshold (e.g., and above a nominal contact-detection intensity threshold IT_0 below which the contact is no longer detected), the device will move a focus selector in accordance with movement of the contact on the touch-sensitive surface without performing an operation associated with the light press intensity threshold or the deep press intensity threshold. Generally, unless otherwise stated, these intensity thresholds are consistent between different sets of user interface figures.

[00144] An increase of intensity of the contact from an intensity below the light press intensity threshold IT_L to an intensity between the light press intensity threshold IT_L and the deep press intensity threshold IT_D is sometimes referred to as a "light press" input. An increase of intensity of the contact from an intensity below the deep press intensity threshold IT_D to an intensity above the deep press intensity threshold IT_D is sometimes referred to as a "deep press" input. An increase of intensity of the contact from an intensity below the contact-detection intensity threshold IT_0 to an intensity between the contact-detection intensity threshold IT_0 and the light press intensity threshold IT_L is sometimes referred to as detecting the contact on the touch-surface. A decrease of intensity of the contact from an intensity above the contact-detection intensity threshold IT_0 to an intensity below the contact intensity threshold IT_0 is sometimes referred to as detecting liftoff of the contact from the

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touch-surface. In some embodiments IT_0 is zero. In some embodiments IT_0 is greater than zero. In some illustrations a shaded circle or oval is used to represent intensity of a contact on the touch-sensitive surface. In some illustrations a circle or oval without shading is used represent a respective contact on the touch-sensitive surface without specifying the intensity of the respective contact.

[00145] In some embodiments described herein, one or more operations are performed in response to detecting a gesture that includes a respective press input or in response to detecting the respective press input performed with a respective contact (or a plurality of contacts), where the respective press input is detected based at least in part on detecting an increase in intensity of the contact (or plurality of contacts) above a press-input intensity threshold. In some embodiments, the respective operation is performed in response to detecting the increase in intensity of the respective contact above the press-input intensity threshold (e.g., a "down stroke" of the respective press input). In some embodiments, the press input includes an increase in intensity of the respective contact above the press-input intensity threshold and a subsequent decrease in intensity of the contact below the press-input intensity threshold, and the respective operation is performed in response to detecting the subsequent decrease in intensity of the respective contact below the press-input threshold (e.g., an "up stroke" of the respective press input).

[00146] In some embodiments, the device employs intensity hysteresis to avoid accidental inputs sometimes termed "jitter," where the device defines or selects a hysteresis intensity threshold with a predefined relationship to the press-input intensity threshold (e.g., the hysteresis intensity threshold is X intensity units lower than the press-input intensity threshold or the hysteresis intensity threshold is 75%, 90% or some reasonable proportion of the press-input intensity threshold). Thus, in some embodiments, the press input includes an increase in intensity of the respective contact above the press-input intensity threshold and a subsequent decrease in intensity of the contact below the hysteresis intensity threshold that corresponds to the press-input intensity threshold, and the respective operation is performed in response to detecting the subsequent decrease in intensity of the respective contact below the hysteresis intensity threshold (e.g., an "up stroke" of the respective press input). Similarly, in some embodiments, the press input is detected only when the device detects an increase in intensity of the contact from an intensity at or below the hysteresis intensity threshold to an intensity at or above the press-input intensity threshold and, optionally, a subsequent decrease in intensity of the contact to an intensity at or below the hysteresis

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intensity, and the respective operation is performed in response to detecting the press input (e.g., the increase in intensity of the contact or the decrease in intensity of the contact, depending on the circumstances).

[00147] For ease of explanation, the description of operations performed in response to a press input associated with a press-input intensity threshold or in response to a gesture including the press input are, optionally, triggered in response to detecting either: an increase in intensity of a contact above the press-input intensity threshold, an increase in intensity of a contact from an intensity below the hysteresis intensity threshold to an intensity above the press-input intensity threshold, a decrease in intensity of the contact below the press-input intensity threshold, and/or a decrease in intensity of the contact below the hysteresis intensity threshold corresponding to the press-input intensity threshold. Additionally, in examples where an operation is described as being performed in response to detecting a decrease in intensity of a contact below the press-input intensity threshold, the operation is, optionally, performed in response to detecting a decrease in intensity of the contact below a hysteresis intensity threshold corresponding to, and lower than, the press-input intensity threshold.

USER INTERFACES AND ASSOCIATED PROCESSES

Previewing Content

[00148] Many electronic devices allow users to interact with items such as documents. A document may reside in a folder or attached another document, such as an email. In some methods, if the user wants to look at the contents of the document, the user would have to open the document in the associated application. This can be tedious and wasteful of system resources, as the user may merely wish to view the document contents quickly. The embodiments below improve on existing methods of interacting with documents by allowing the user to preview a document or open the document based on the intensity of a contact corresponding to interacting with a document icon. If the gesture includes a contact with a high intensity, the device displays a preview of the document is displayed. If the gesture includes a contact with a relatively low intensity, the device opens the document in the associated application. The user is thus able to control whether the device opens the document or opens a preview the document by adjusting the intensity of a contact on a touch-sensitive surface.

[00149] Figures 5A-5S illustrate exemplary user interfaces for previewing content in accordance with some embodiments. The user interfaces in these figures are used to illustrate

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the processes described below, including the processes in Figures 6A-6C. Figures 5A-5S include intensity diagrams that show the current intensity of the contact on the touch-sensitive surface relative to a plurality of intensity thresholds including a light press intensity threshold (e.g., "IT_L") and a deep press intensity threshold (e.g., "IT_D"). In some embodiments, operations similar to those described below with reference to IT_D are performed with reference to a different intensity threshold (e.g., "IT_L"), and vice versa.

[00150] Figure 5A illustrates window 2404 of an application displayed on display 450 (e.g., display 340, touch screen 112) of a device (e.g., device 300, 100). The application with which window 2404 is associated is an application that displays content, such as an email application. Content, such as document 2406, is displayed in window 2404. Document 2406 optionally includes embedded content, attached content, and/or links to other content (for convenience, collectively referred to below as "embedded content"). The embedded content is, optionally, represented by document icons 2408. For example, document 2406 includes document icons 2408-1 and 2408-2, each of which corresponds to respective embedded content (e.g., a document) embedded in document 2406. The respective documents corresponding to icons 2408-1 and 2408-2 are associated with respective applications. For example, icon 2408-1 optionally corresponds to a presentation document, which is associated with a presentation application. The document associated with an icon 2408 is, optionally, a word processing document, a spreadsheet, a presentation, a drawing, a graphic or image, an audio file, a video file, a text document, or a Portable Document Format document (sometimes referred to as a PDF).

[00151] Cursor 2410 is also displayed on display 450. Cursor 2410 is an example of a focus selector. A user may move cursor 2410 on display 450 (e.g., using touch-sensitive surface 451 of the device) to bring focus to an element displayed on display 450 (e.g., a user interface object, an icon, a link, etc.) by moving a contact on touch-sensitive surface 451. Figure 5A shows movement of contact 2412 down and to the left on touch-sensitive surface 451 that causes the device to move cursor 2410 down and to the left on display 450.

[00152] Figure 5B shows gesture detected on touch-sensitive surface 450 while cursor 2410 is located over document icon 2408-1. The gesture includes a press input corresponding to an increase in intensity of contact 2412 on touch-sensitive surface 451 from an intensity below the light press intensity threshold IT_L to an intensity above the light press intensity threshold IT_L. Contact 2412 in the gesture is determined to have a maximum intensity that is below the deep press intensity threshold (e.g., "IT_D").

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[00153] In response to the detection of the gesture including contact 2412 and in accordance with the determination that contact 2412 had a maximum intensity that is below the deep press intensity threshold (e.g., "IT_D"), the document corresponding to document icon 2408-1 is displayed in a new application window of the application with which the document is associated. For example, Figure 5C shows Document 1 2416, which corresponds to document icon 2408-1, displayed in new application window 2414 for the application with which Document 1 2416 is associated (e.g., if document 1 is a word processing document, then the application associated with application window 2414 is a word processing document creation application). Application window 2414 is, optionally, displayed over window 2404. The application with which Document 1 2416 is associated is, optionally, different from the application with which window 2404 is associated (e.g., Document 1 is associated with a word processing creation application and window 2404 is a window of an email application). In some embodiments, Document 1 2416 is editable by the user while displayed in application window 2414. In some embodiments, Document 1 2416 is displayed in application window 2414 after liftoff of contact 2412 is detected. For example, in Figure 5C, the device has detected a liftoff of contact 2412, and Document 1 2416 is displayed after (or in response to) the liftoff of contact 2412.

[00154] While Document 1 2416 is displayed in application window 2414, focus is, optionally, taken away from Document 1 2416 in application window 2414. For example, in Figure 5D, the device detects a gesture including movement of contact 2418 across touch-sensitive surface 451 to the location of contact 2418 in Figure 5E and in response to detecting movement of contact 2418, the device moves cursor 2410 across display 450. In Figure 5E, the device detects an increase in the intensity of contact 2418 from an intensity below IT_L to an intensity above IT_L and in response to detecting the increase in intensity of contact 2418, of the device the device moves focus away from application window 2414. In response to detection of the gesture including the increase in intensity of contact 2418, Document 1 2416 remains displayed in application window 2414 (e.g., the application associated with Document 1 does not cease to be displayed solely based on focus being shifted to a different element in the user interface).

[00155] Figures 5F-5G shows a gesture including contact 2420 (e.g., a tap-and-hold gesture) detected on touch-sensitive surface 450 while cursor 2410 is located over icon 2408-1. The gesture includes detecting an increase in intensity of contact 2420 on touch-sensitive surface 451 from an intensity below a deep press intensity threshold (e.g., "IT_D") to an

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intensity above the deep press intensity threshold (e.g., "IT_D"). The contact has an intensity that is determined by the device throughout the gesture. The contact in gesture 2420 is determined to have reached an intensity during the gesture that is above the deep press intensity threshold (e.g., "IT_D").

[00156] In response to the detection of the gesture including contact 2420 and in accordance with the determination that contact 2420 reached an intensity during the gesture that is above the deep press intensity threshold (e.g., "IT_D"), preview 2424 of Document 1 2416 is displayed in preview interface 2422, and application window 2414 with Document 1 2416 is not displayed, as shown in Figure 5H. Preview interface 2422 is, optionally, a pop-up window.

[00157] In some embodiments, an animation showing a transformation of icon 2408-1 to preview interface 2422 is displayed. For example, Figures 5F-5H shows, in response to the detection of the gesture that includes the increase in intensity of contact 2420 from an intensity below the deep press intensity threshold (e.g., "IT_D") to an intensity above the deep press intensity threshold (e.g., "IT_D"), the device expands icon 2408-1 into preview interface 2422, showing an animation that includes one or more intermediate stages 2421. The progression of the expansion animation is, optionally, determined in accordance with the intensity of contact 2420 in the gesture. For example, the higher the intensity of the contact (while remaining above the deep press intensity threshold), the faster the animation progresses. Alternatively, the progression of the transformation animation is mapped to various intensity values. As the intensity of contact 2420 increases through the various intensity values, the animation progresses, and the animation is reversed if the intensity decreases below the intensity values.

[00158] In some embodiments, preview 2424 is displayed in preview interface 2422 before liftoff of contact 2420 is detected. For example, in Figures 5F-5H, contact 2420 continues to be detected on touch-sensitive surface 451 as preview interface 2422 is displayed in response to detection of the gesture including the increase in intensity of contact 2420.

[00159] In some embodiments, preview interface 2422, in which preview 2424 is displayed, is associated with a preview application for previewing documents associated with multiple different applications (e.g., the preview application can display read-only views of word processing documents, presentation documents, PDFs and spreadsheet documents). The

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preview application is different from the application with which application window 2414 is associated. For example, if Document 1 2416 is a presentation document, then application window 2414 is a window of a presentation application, and preview interface 2422 is an interface of a preview application that is configured to read the presentation document as well as other types of documents (e.g., word processing documents, PDFs and spreadsheet documents). In some embodiments, the preview application does not enable editing of Document 1 2416 while it is displayed as preview 2424 (e.g., Document 1 2416 is read-only while displayed as preview 2424 in preview interface 2422), and the application associated with application window 2414 does allow editing of Document 1 2416 while displayed in application window 2414. In some embodiments, the application associated with application window 2414 has a set of document editing capabilities, and the preview application is missing one or more of the set of document editing capabilities (e.g., the preview application provides limited editing capabilities compared to the "full set" of editing capabilities provided by the application associated with application window 2414).

[00160] While preview 2424 is displayed in preview interface 2422, focus is, optionally, taken away from preview 2424 in preview interface 2422. For example, in Figure 5I, the device detects a tap gesture including detecting contact 2426 on touch-sensitive surface 451. In response to the detection of the tap gesture while cursor 2410 is at a location on display 450 that is remote from preview interface 2422, the device moves focus away from preview window 2422 and ceases to display preview interface 2422 and preview 2424, as shown in Figure 5J.

[00161] Figures 5J-5L illustrate a gesture including movement of contact 2428 across touch-sensitive surface 451 and a press input including an increase in intensity of contact 2428 from an intensity below the deep press intensity threshold (e.g., "IT_D") to an intensity above the deep press intensity threshold (e.g., "IT_D") while cursor 2410 is located over icon 2408-1. In response to detecting movement of contact 2428 upward and to the left on touch-sensitive surface while contact 2428 has an intensity between IT_0 and IT_L the device moves cursor 2410 upward and to the left on display. In response to the detection of intensity of the contact increase in intensity of contact 2428 from an intensity below the deep press intensity threshold (e.g., "IT_D") to an intensity above the deep press intensity threshold (e.g., "IT_D"), the device changes the appearance of icon 2408-1 to indicate that preview 2424 will be displayed in response to detection of an end of the gesture (e.g., liftoff of contact 2428). For example, the change in appearance includes decreasing the size of icon 2408-1, as shown in

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Figure 5L. The size decrease is, optionally, displayed as an animation in which the progression of the animation is determined in accordance with the intensity of the contact (e.g., icon 2408-1 decreases in size more as the intensity increases above IT_D). As the intensity of contact 2428 decreases toward a liftoff (and thus the end of the gesture), icon 2408-1 is animated to transform into preview interface 2422 with preview 2424, as shown in Figures 5M-5O.

[00162] In some embodiments, document icons 2408-1 and 2408-2 are not displayed within a document, and the corresponding documents are not embedded in another document. For example, document icons 2408-1 and 2408-2 are, optionally, displayed on a desktop user interface or in a listing of files in a folder; document icons 2408-1 and 2408-2 optionally represent respective shortcuts to the corresponding documents or the documents themselves.

[00163] Figures 5P-5S illustrate an example of the user interfaces described above with reference to Figures 5A-5O implemented on a device with a touch-sensitive display 2430 (e.g., device 100 with touch screen 112). Figure 5P shows document icons 2408-1 and 2408-2 displayed in document 2406, on touch-sensitive display 2430. A gesture including an increase in intensity of contact 2432 from an intensity below the light press intensity threshold (e.g., "IT_L") to an intensity above the light press intensity threshold (e.g., "IT_L") is detected on touch-sensitive display 2430 while a focus selector (e.g., contact 2432) is over icon 2408-1. Contact 2432 in the gesture is determined to have a maximum intensity that is below the deep press intensity threshold (e.g., "IT_D"). In response to the detection of the gesture including contact 2432 and in accordance with the determination that the maximum intensity of the contact 2432 is below the deep press intensity threshold (e.g., "IT_D"), the device displays application window 2414 with Document 1 2416 on touch-sensitive display 2430, as shown in Figure 5Q.

[00164] Figure 5R shows document icons 2408-1 and 2408-2 displayed in document 2406, on touch-sensitive display 2430. A gesture including an increase in intensity of contact 2434 from an intensity below the light press intensity threshold (e.g., "IT_L") to an intensity above the light press intensity threshold (e.g., "IT_L") detected on touch-sensitive display 2430 while a focus selector (e.g., contact 2434) is over 2408-1. Contact 2434 in the gesture is determined to have reached an intensity during the gesture that is above the deep press intensity threshold (e.g., "IT_D"). In response to the detection of the gesture including contact 2434 and in accordance with the determination that the contact 2424 in the gesture reached an intensity during the gesture that is above the deep press intensity threshold (e.g., "IT_D"),

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preview interface 2422 and preview 2424 are displayed on display 2430, as shown in Figure 5S.

[00165] Figures 6A-6C are flow diagrams illustrating a method 2500 of previewing content in accordance with some embodiments. The method 2500 is performed at an electronic device (e.g., device 300, Figure 3, or portable multifunction device 100, Figure 1A) with a display, a touch-sensitive surface, and one or more sensors to detect intensity of contacts with the touch-sensitive surface. In some embodiments, the display is a touch screen display and the touch-sensitive surface is on the display. In some embodiments, the display is separate from the touch-sensitive surface. Some operations in method 2500 are, optionally, combined and/or the order of some operations are, optionally, changed.

[00166] As described below, the method 2500 provides an intuitive way to preview content. The method reduces the cognitive burden on a user when previewing content, thereby creating a more efficient human-machine interface. For battery-operated electronic devices, enabling a user to preview content faster and more efficiently conserves power and increases the time between battery charges.

[00167] The device displays (2502) a plurality of document icons, including a respective document icon corresponding to a respective electronic document associated with a respective application. For example, document icons 2408-1 and 2408-2 are displayed on display 450 or touch-sensitive display 2430, as shown in Figure 5A or 5P. Document icon 2408-1 corresponds to Document 1 2416, which is associated with an application (e.g., Document 1 is a word processing document associated with a word processing document creation application, or Document 1 is a presentation document associated with a presentation document creation application).

[00168] While a focus selector (e.g., a selection box, a cursor, or a representative point corresponding to a contact such as a finger contact or a stylus contact) is over the respective document icon, the device detects (2504) a gesture that includes a contact on the touch-sensitive surface . For example, while cursor 2410 is located over icon 2408-1, the gesture including the increase in intensity of contact 2412 in Figures 5B-5C (or the gesture including the increase in intensity of contact 2420 in Figures 5F-5H) is detected on touch-sensitive surface 451. As another example, the gesture including the increase in intensity of contact 2432 in Figures 5P-5Q (or the gesture including the increase in intensity of contact 2434 in Figures 5R-5S) is detected on touch-sensitive display 2430 while the contact that increases in

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intensity during the gesture (e.g., contact 2432 or contact 2434, respectively) is over icon 2408-1.

[00169] In response (2506) to detecting the gesture, in accordance with a determination that the contact had a maximum intensity during the gesture that was below a respective intensity threshold (e.g., "IT_D"), the device displays (2508) the electronic document in a new application window of the respective application. For example, in response to the detection of the gesture that includes the increase in intensity of contact 2412 and in accordance with the determination that contact 2412 had a maximum intensity during the gesture that is below the intensity threshold, Document 1 2416 is displayed in application window 2414, as shown in Figure 5C. In response to the detection of the gesture that includes the increase in intensity of contact 2432 and in accordance with the determination that contact 2432 had a maximum intensity during the gesture that is below the intensity threshold, Document 1 2416 is displayed in application window 2414, as shown in Figure 5Q. In some embodiments, the respective electronic document is (2510) displayed in the new window of the respective application after detecting liftoff of the contact on the touch-sensitive surface. For example, Document 1 2416 is displayed in application window 2414 after detecting liftoff of contact 2412 as shown in Figure 5C (or after liftoff of contact 2432, as shown in Figure 5Q).

[00170] In response (2506) to detecting the gesture, in accordance with a determination that the contact reached an intensity during the gesture that was above the respective intensity threshold (e.g., "IT_D"), the device displays (2512) a preview of the respective electronic document without displaying a new application window of the respective application. For example, in response to the detection of the gesture that includes the increase in intensity of contact 2420 and in accordance with the determination that contact 2420 had reached an intensity during the gesture that is above the intensity threshold (e.g., "IT_D"), the device displays preview 2424 of Document 1 2416 in preview interface 2422, as shown in Figure 5H. Similarly, in response to the detection of the gesture that includes the increase in intensity of contact 2434 and in accordance with the determination that contact 2434 had reached an intensity during the gesture that is above the intensity threshold, the device displays preview 2424 of Document 1 2416 in preview interface 2422, as shown in Figure 5S.

[00171] In some embodiments, displaying the preview of the respective electronic document includes (2514) displaying an animation of the respective document icon transforming into the preview of the respective electronic document, and a progression of the

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animation is determined in accordance with intensity of the contact on the touch-sensitive surface (e.g., the animation progresses at a speed determined by contact intensity or the animation progresses through a plurality of intermediate states that are mapped to particular intensity thresholds, so that as the user presses down harder the animation progresses further toward displaying the preview and if the user reduces the intensity of the contact, the animation progresses back toward displaying the icon). For example, Figures 5L-5O show an animation of icon 2408-1 transforming into preview interface 2422. The progression of the animation is, optionally, determined in accordance with the intensity of contact 2428. In some embodiments, the preview of the electronic document is (2516) displayed prior to detecting liftoff of the contact from the touch-sensitive surface. For example, Figures 5F-5H show preview 2424 displayed while contact 2420 is still detected on touch-sensitive surface 451.

[00172] In some embodiments, the device includes a preview application (e.g., Quick Look by Apple Inc., Gloobus Preview, or Windows Picture and Fax Viewer by Microsoft Inc.) for previewing documents associated with a plurality of different applications, the preview application is distinct from the respective application, and the preview of the electronic document is (2518) displayed in the preview application. For example, preview interface 2422 is an interface for a preview application, which is different from the application with which Document 1 2416 is associated.

[00173] In some embodiments, the respective application includes (2520) a plurality of document editing capabilities for editing the respective electronic document, and the preview application does not include a respective document editing capability of the plurality of document editing capabilities. For example, in the preview application content of the electronic document cannot be modified, whereas in the respective application, content of the electronic document can be modified. However, in some situations, the preview application provides limited document editing capabilities such as rotating, renaming, modifying metadata, etc. For example, Document 1 2416 displayed in application window 2414 in Figures 5C-5E and 5Q is, optionally, editable in accordance with the editing capabilities of the application with which Document 1 2416 is associated (e.g., a word processing document creation application), and preview 2424 in Figures 5H-5I, 5O and 5S is, optionally, read-only or editable in accordance with the editing capabilities of the preview application (e.g., a dedicated electronic document preview application) that is less than the editing capabilities of the application with which Document 1 2416 is associated.

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[00174] In some embodiments, while detecting the contact on the touch-sensitive surface, the device determines (2522) that the contact has exceeded the respective intensity threshold (e.g., "IT_D"). In response to determining that the contact has exceeded the respective intensity threshold (e.g., "IT_D"), the device changes (2524) an appearance of the document icon to indicate that a preview of the respective electronic document will be displayed in response to detecting an end of the gesture. For example, Figures 5K-5L show a gesture including an increase in intensity of contact 2428 detected on touch-sensitive surface 451. In Figure 5L, contact 2428 is determined to exceed the deep press intensity threshold (e.g., "IT_D"), and in response, the device changes the appearance of icon 2408-1 by reducing the size of icon 2408-1, as shown in Figure 5L. In some embodiments, changing an appearance of the document icon includes (2526) displaying an animation of the document icon growing smaller, where a progression of the animation is determined in accordance with an intensity of the contact. As shown in Figure 5L, for example, icon 2408-1 decreases in size. In some embodiments, how much icon 2408-1 decreases in size is, optionally, determined in accordance with the intensity of the contact 2428. In some embodiments, the device displays the icon gradually decreasing in size as the intensity of contact 2428 gradually increases through intensities above the deep press intensity threshold (e.g., "IT_D").

[00175] In some embodiments, after detecting the gesture, the device detects (2528) a subsequent gesture that corresponds to moving focus away from a representation of the electronic document. In response (2530) to detecting the subsequent gesture, in accordance with a determination that the representation of the electronic document is the new application window in which the electronic document was opened, the device maintains (2532) the electronic document in the new application window. For example, Figures 5D-5E show a gesture including movement of contact 2418 across the touch-sensitive surface and a subsequent increase in intensity of contact 2418 from an intensity below the light press intensity threshold (e.g., "IT_L") to an intensity above the light press intensity threshold (e.g., "IT_L"), that is detected on touch-sensitive surface 451. The gesture shown in Figures 5D-5E that includes the movement and increase in intensity of contact 2418 takes focus away from Document 1 2416 in application window 2414. However, in response to the detection of the gesture shown in Figures 5D-5E that includes the movement and increase in intensity of contact 2418, Document 1 2416 remains displayed in application window 2414, as shown in Figure 5E, where Document 1 2416 is still displayed in application window 2414 after detecting a press input including the increase in intensity of contact 2418. In contrast, in some

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embodiments, in response to detecting the subsequent gesture (2530), in accordance with a determination that the representation of the electronic document is a preview of the electronic document, the device ceases (2534) to display the preview of the electronic document. For example, Figures 5I-5J show a tap gesture including detection of contact 2426 for less than a predefined time threshold detected on touch-sensitive surface 451. The tap gesture in Figure 5I that includes contact 2426 takes focus away from preview 2424 in preview interface 2422. In response to the detecting the tap gesture that includes detection of contact 2426, the device ceases to display preview 2424, as shown in Figure 5J.

[00176] It should be understood that the particular order in which the operations in Figures 6A-6C have been described is merely exemplary and is not intended to indicate that the described order is the only order in which the operations could be performed. One of ordinary skill in the art would recognize various ways to reorder the operations described herein. Additionally, it should be noted that details of other processes described herein with respect to other methods described herein (e.g., those listed in paragraph [0043]) are also applicable in an analogous manner to method 2500 described above with respect to Figures 6A-6C. For example, the contacts, gestures, icons, intensity thresholds, focus selectors, and animations described above with reference to method 2500 optionally have one or more of the characteristics of the contacts, gestures, icons, intensity thresholds, focus selectors, and animations described herein with reference to other methods described herein (e.g., those listed in paragraph [0043]). For brevity, these details are not repeated here.

[00177] In accordance with some embodiments, Figure 7 shows a functional block diagram of an electronic device 2600 configured in accordance with the principles of the various described embodiments. The functional blocks of the device are, optionally, implemented by hardware, software, or a combination of hardware and software to carry out the principles of the various described embodiments. It is understood by persons of skill in the art that the functional blocks described in Figure 7 are, optionally, combined or separated into sub-blocks to implement the principles of the various described embodiments. Therefore, the description herein optionally supports any possible combination or separation or further definition of the functional blocks described herein.

[00178] As shown in Figure 7, an electronic device 2600 includes a display unit 2602 configured to display a plurality of document icons, including a respective document icon corresponding to a respective electronic document associated with a respective application; a touch-sensitive surface unit 2604 configured to receive gestures that include contacts; one or

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more sensor units 2605 configured to detect intensity of contacts with the touch-sensitive surface unit 2604; and a processing unit 2606 coupled to the display unit 2602, the touch-sensitive surface unit 2604, and the sensor units 2605. In some embodiments, the processing unit 2606 includes a detecting unit 2608, a display enabling unit 2610, a maintaining unit 2612, a ceasing unit 2614, a determining unit 2616, and a changing unit 2618.

[00179] The processing unit 2606 is configured to: while a focus selector is over the respective document icon, detect a gesture that includes a contact on the touch-sensitive surface unit 2604 (e.g., with the detecting unit 2608); and in response to detecting the gesture: in accordance with a determination (e.g., with the determining unit 2616) that the contact had a maximum intensity during the gesture that was below a respective intensity threshold, enable display of the electronic document in a new application window of the respective application (e.g., with the display enabling unit 2610); and in accordance with a determination (e.g., with the determining unit 2616) that the contact reached an intensity during the gesture that was above the respective intensity threshold, enable display of a preview of the respective electronic document without enabling display of a new application window of the respective application (e.g., with the display enabling unit 2610).

[00180] In some embodiments, enabling display of the preview of the respective electronic document includes enabling display of an animation of the respective document icon transforming into the preview of the respective electronic document, and a progression of the animation is determined in accordance with intensity of the contact on the touch-sensitive surface unit 2604 (e.g., with the display enabling unit 2610).

[00181] In some embodiments, the respective electronic document is displayed in the new window of the respective application after detecting liftoff of the contact on the touch-sensitive surface unit 2604.

[00182] In some embodiments, the preview of the electronic document is displayed prior to detecting liftoff of the contact from the touch-sensitive surface unit 2604.

[00183] In some embodiments, the device includes a preview application for previewing documents associated with a plurality of different applications, the preview application is distinct from the respective application, and the preview of the electronic document is displayed in the preview application.

[00184] In some embodiments, the respective application includes a plurality of document editing capabilities for editing the respective electronic document, and the preview

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application does not include a respective document editing capability of the plurality of document editing capabilities.

[00185] In some embodiments, the processing unit 2606 is configured to: after detecting the gesture, detect a subsequent gesture that corresponds to moving focus away from a representation of the electronic document (e.g., with the detecting unit 2608); and in response to detecting the subsequent gesture: in accordance with a determination that the representation of the electronic document is the new application window in which the electronic document was opened, maintain the electronic document in the new application window (e.g., with the maintaining unit 2612); and in accordance with a determination that the representation of the electronic document is a preview of the electronic document, cease to display the preview of the electronic document (e.g., with the ceasing unit 2614).

[00186] In some embodiments, the processing unit 2606 is configured to: while detecting the contact on the touch-sensitive surface unit 2604, determine that the contact has exceeded the respective intensity threshold (e.g., with the determining unit 2616); and in response to determining that the contact has exceeded the respective intensity threshold, change an appearance of the document icon to indicate that a preview of the respective electronic document will be displayed in response to detecting an end of the gesture (e.g., with the changing unit 2618).

[00187] In some embodiments, changing an appearance of the document icon includes enabling display of an animation of the document icon growing smaller, wherein a progression of the animation is determined in accordance with an intensity of the contact.

[00188] The operations in the information processing methods described above are, optionally implemented by running one or more functional modules in information processing apparatus such as general purpose processors (e.g., as described above with respect to Figures 1A and 3) or application specific chips.

[00189] The operations described above with reference to Figures 6A-6C are, optionally, implemented by components depicted in Figures 1A-1B or Figure 7. For example, detection operation 2504, and displaying operations 2508 and 2512 are, optionally, implemented by event sorter 170, event recognizer 180, and event handler 190. Event monitor 171 in event sorter 170 detects a contact on touch-sensitive display 112, and event dispatcher module 174 delivers the event information to application 136-1. A respective event recognizer 180 of application 136-1 compares the event information to respective event

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definitions 186, and determines whether a first contact at a first location on the touch-sensitive surface (or whether rotation of the device) corresponds to a predefined event or sub-event, such as selection of an object on a user interface, or rotation of the device from one orientation to another. When a respective predefined event or sub-event is detected, event recognizer 180 activates an event handler 190 associated with the detection of the event or sub-event. Event handler 190 optionally utilizes or calls data updater 176 or object updater 177 to update the application internal state 192. In some embodiments, event handler 190 accesses a respective GUI updater 178 to update what is displayed by the application. Similarly, it would be clear to a person having ordinary skill in the art how other processes can be implemented based on the components depicted in Figures 1A-1B.

Previewing Content

[00190] Many electronic devices have user interfaces for browsing content items, such as photos. The content items are, optionally, organized into multiple sets of items. In some methods, to preview the items within a set, a user would need to first select and open the desired set of items as in opening a folder, and then preview the items in the set. This adds additional steps to the previewing process and can make the process tedious if the user is previewing items in multiple sets. The embodiments below improve on these methods by enabling a user to preview items within a set in accordance with movement and intensity of a contact. In the embodiments below, the sets of items are represented by frames displayed in a user interface. The user, using a finger contact, positions a focus selector over a desired frame and moves the focus selector across the frame. As the focus selector moves across the frame, previews of the items are displayed in sequence within the frame. The user may press harder with the contact when a particular preview is displayed to increase the size of that particular preview, and reduce the intensity of the press with the contact to reduce the size of the preview back to the previous size.

[00191] Figures 8A-8W illustrate exemplary user interfaces for previewing content in accordance with some embodiments. The user interfaces in these figures are used to illustrate the processes described below, including the processes in Figures 9A-9C. Figures 8A-8W include intensity diagrams that show the current intensity of the contact on the touch-sensitive surface relative to a plurality of intensity thresholds including a deep press intensity threshold (e.g., "IT_D") and a light press intensity threshold (e.g., "IT_L"). In some

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embodiments, operations similar to those described below with reference to "IT_D" are performed with reference to a different intensity threshold (e.g., "IT_L").

[00192] Figure 8A illustrates user interface 5700 for an application displayed on display 450 (e.g., display 340) of a device (e.g., device 300). User interface 5700 is, optionally, an interface for a content application, such as an image viewer application or a presentation application. One or more frames 5702 are displayed in user interface 5700. Each of the frames 5702 displayed in Figure 8A corresponds to a set of multiple content items. The content items are, for example, photos or individual slides in a presentation. A set of multiple content items are, optionally, for example, a set of photos (e.g., a set of photos from a trip, a set of photos with a particular person as a subject, a set of photos with a common topic) or a presentation with multiple slides. For example, frame 5702-1 corresponds to content items 5704. Frame 5702-2 corresponds to content items 5706. Frame 5702-3 corresponds to content items 5708. Frame 5702-4 corresponds to content items 5710.

[00193] For each frame 5702 in Figure 8A, preview 5707 (e.g., a thumbnail) of an item from the corresponding set is, optionally, displayed in the respective frame. For example, preview 5707 of item 5706-1 is displayed in frame 5702-2. Preview 5707 of item 5706-1 is, optionally, displayed at a size that fills up the entire frame 5702-2 (e.g., fill height or fill width of frame 5702-2, depending on the aspect ratio of item 5706-1), with the possibility that parts of preview 5707 of item 5706-1 is, optionally, cropped by the boundaries of frame 5702-2.

[00194] Cursor 5712 is displayed in user interface 5700. Cursor 5712 is an example of a focus selector. In Figure 8A, cursor 5712 is positioned away from frames 5702. Contact 5714 is detected on touch-sensitive surface 451. A user is enabled to move contact 5714 on touch-sensitive surface 451 to move cursor 5712 to a position over frame 5702-2, as shown in Figure 8B.

[00195] When cursor 5712 is positioned over frame 5702-2, a preview mode is, optionally, activated for frame 5702-2. While the preview mode for frame 5702-2 is activated, previews of items 5706 is, optionally, displayed in sequence, as described below. The previews are, optionally, displayed to fill up frame 5702-2 (with cropping as needed) or at their respective original aspect ratios (with letterboxing or pillarboxing as needed). Regardless of whether a preview is displayed to fill up frame 5702-2 or at the original aspect ratio, the size of the preview is constrained by the size of frame 5702-2 (hereinafter "frame

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size" for convenience) as defined by the boundaries of frame 5702-2. For example, Figure 8B shows preview 5707 of item 5706-1 displayed in its original aspect ratio, at a size limited by the frame size.

[00196] While cursor 5712 is located over frame 5702-2, contact 5716 is detected on touch-sensitive surface 451. It should be appreciated that contact 5716 is, optionally, a continuation of contact 5714 without an intervening liftoff of contact 5714, or a new contact detected on touch-sensitive surface 451 after a liftoff of contact 5714.

[00197] While cursor 5712 is located over frame 5702-2, contact 5716 moves 5715 substantially (e.g., at most 20 degrees above or below the horizontal) laterally (e.g., from the right to the left, or vice versa) on touch-sensitive surface 451 in Figures 8B-8C. In response to detection of the substantially lateral movement 5715 of contact 5716, cursor 5712 moves across frame 5702-2 in a direction corresponding to movement 5715, and preview 5707 of item 5706-2 is displayed at a size limited by the frame size, as shown in Figure 8C. Item 5706-2 is a next item from item 5706-1 within a sequence of items 5706. The sequence of items are, optionally, ordered by any suitable criterion or criteria, such as chronologically based on the date/time the image was taken or last modified, or alphabetically based on filename.

[00198] As contact 5716 continues to move laterally 5717, cursor 5712 continues to move in Figures 8C-8D, in response to movement 5717, across frame 5702-2 in accordance with movement 5717, and additional item(s) in the sequence of items 5706 are displayed. For example, Figure 8D shows preview 5707 of item 5706-3, which is a next item from item 5706-2 in the sequence, displayed in frame 5702-2 in response to detection of continued lateral movement 5717 of contact 5716. It should be appreciated that the "next" item described above is, optionally, a previous or a subsequent item in the sequence of items, depending on the lateral direction of the movement of contact 5716 that moves cursor 5712 across frame 5702-2.

[00199] In some embodiments, the order in which the sequence of items is previewed depends on the position of the cursor relative to the right and left boundaries or edges of the frame. For example, items 5706 are, optionally, a chronologically ordered set of images, the left edge of frame 5702-2 corresponds to the beginning of the set, and the right edge of frame 5702-2 corresponds to the end of the set. As cursor 5712 is moved from right to left (or vice versa) across frame 5702-2, previews of items 5706 are displayed in chronological order

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based on the direction of movement. Thus, in Figures 8B-8D, with cursor 5712 starting nearer to the right edge of frame 5702-2, items 5706-1 through 5706-3, for which previews are displayed, are items that are in reverse chronological order within items 5706. Thus, in some embodiments, moving cursor 5712 from right to left within frame 5702-2 causes items 5706 to be scanned in reverse order, while moving cursor 5712 from left to right within frame 5702-2 causes items 5706 to be scanned in order.

[00200] Figure 8D also shows contact 5716 ceasing to substantially move on touch-sensitive surface 451. While contact 5716 is substantially stationary on touch-sensitive surface 451, an increase in the intensity of contact 5716 is detected (e.g., from an intensity below IT_L to an intensity above IT_D), as shown in Figures 8E-8G. In response to detection of the increase in intensity of contact 5716, the size of preview 5707 of item 5706-3 is increased to a size larger than the frame size, as shown in Figure 8G. Preview 5707 of item 5706-3 is no longer limited by the frame size. In some embodiments, the size increase is, optionally, displayed as an animation. For example, an animation of preview 5707 of item 5706-3 expanding in size, an instant of which is shown in Figure 8F, is, optionally, displayed. The animation optionally follows the increase in the intensity of contact 5716; the size of preview 5707 increases as the intensity of contact 5716 increases, as shown in Figures 8D-8G.

[00201] While preview 5707 of item 5706-3 is displayed at the larger size, the intensity of contact 5716 is, optionally, decreased (e.g., from an intensity above IT_D to an intensity below IT_L), as shown in Figures 8H-8J. In response to detection of the decrease in intensity of contact 5716, the size of preview 5707 of item 5706-3 is decreased back to the earlier size that was limited by the frame size, as shown in Figure 8J. In some embodiments, the size decrease is, optionally, displayed as an animation. For example, an animation of preview 5707 of item 5706-3 contracting in size, an instant of which is shown in Figure 8I, is, optionally, displayed. The animation optionally follows the decrease in the intensity of contact 5716; the size of preview 5707 decreases as the intensity of contact 5716 decreases, as shown in Figures 8H-8J.

[00202] In the description above, contact 5716, from movement 5715 through the decrease in intensity (Figure 8B through Figure 8J), is an unbroken contact. Thus, in some embodiments, contact 5716 is not lifted off from touch-sensitive surface 451 from the time of movement 5715 through the decrease in intensity.

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[00203] In some embodiments, the decrease in intensity of contact 5716 includes a liftoff of contact 5716. For example, returning to, and continuing from Figure 8H, while preview 5707 of item 5706-3 is displayed at the larger size, a decrease in the intensity of contact 5716, including a liftoff of contact 5716, is detected, as shown in Figure 8K. In response to the detection of the decrease in the intensity of contact 5716, including the liftoff of contact 5716, the size of preview 5707 of item 5706-3 is decreased back to the earlier size that was limited by the frame size, as shown in Figure 8L. In some embodiments an animation similar to that shown in Figures 8H-8J is displayed in response to detecting liftoff of contact 5716.

[00204] While preview 5707 of item 5706-3 is displayed at the size larger than the frame size, as in Figure 8G, contact 5716 is, optionally, moved laterally on touch-sensitive surface 451 by the user. For example, Figure 8M shows preview 5707 of item 5706-3 displayed at the larger size, as in Figure 8G. Figure 8M shows contact 5716 moving 5718 rightward on touch-sensitive surface 451. In some embodiments, preview 5707 of item 5706-3 remains displayed at the larger size in response to detection of movement 5718 of contact 5716, as shown in Figure 8N, where movement 5718 did not change the item being previewed. Thus, in some embodiments, while preview 5707 is displayed at the larger size, scanning or scrolling of previews of items 5706 at the larger size is not available.

[00205] In contrast, in some embodiments, in response to detection of movement 5718 of contact 5716 in Figure 8M, cursor 5712 moves across frame 5702-2 in accordance with movement 5718, and display of preview 5707 of item 5706-3 is replaced with display of preview 5707 of item 5706-2, as shown in Figure 8O. Thus, in these embodiments, previews of items 5706 are, optionally, scanned or scrolled while displayed at the larger size like previews of items 5706 are, optionally, scanned within frame 5702-2, as described above with reference to Figures 8B-8D.

[00206] Figures 8P-8W illustrates an example of the user interfaces described above implemented on a device (e.g., device 100) with a touch screen 112. Figure 8P illustrates user interface 5730 for an application displayed on touch screen 112 of a device (e.g., device 100). User interface 5730 is, optionally, an interface for a content application, such as an image viewer application or a presentation application. One or more frames 5732 are displayed in user interface 5730. Each frame 5732 in Figure 8P corresponds to a set of multiple content items. The content items are, for example, photos or individual slides in a presentation. A set of multiple content items are, optionally, a set of photos or a presentation with multiple

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slides. For example, frame 5732-1 corresponds to content items 5734. Frame 5732-2 corresponds to content items 5736. Frame 5732-3 corresponds to content items 5738. Frame 5732-4 corresponds to content items 5740.

[00207] For each frame 5732 in Figure 8P, a preview (e.g., a thumbnail) of an item from the corresponding set is, optionally, displayed in the respective frame. For example, preview 5737 of item 5736-1 is displayed in frame 5732-2. Preview 5737 of item 5736-1 is, optionally, displayed at a size that fills up the entire frame 5732-2 (e.g., fill height or fill width of frame 5732-2, depending on the aspect ratio of item 5736-1), with the possibility that parts of preview 5737 of item 5736-1 are, optionally, cropped off by the boundaries of frame 5732-2.

[00208] Contact 5742 is detected on touch screen 112 over frame 5732-2. In response to detection of contact 5742 over frame 5732-2, a preview mode is, optionally, activated for frame 5732-2, as shown in Figure 8Q. While the preview mode for frame 5732-2 is activated, previews of items 5736 are, optionally, displayed in sequence, as described below. The previews are, optionally, displayed to fill up frame 5732-2 (with cropping as needed) or at their respective original aspect ratios (with letterboxing or pillarboxing as needed). Regardless of whether a preview is displayed to fill up frame 5732-2 or at the original aspect ratio, the size of the preview is constrained by the size of frame 5732-2 (hereinafter "frame size" for convenience) as defined by the boundaries of frame 5732-2. For example, Figure 8Q shows preview 5737 of item 5736-1 displayed in its original aspect ratio, at a size limited by the frame size.

[00209] While contact 5742 is located over frame 5732-2, contact 5742 moves 5744 substantially (e.g., at most 20 degrees above or below the horizontal) laterally (e.g., from the right to the left, or vice versa) on touch screen 112. In response to detection of the substantially lateral movement of contact 5742, preview 5737 of item 536-2 is displayed at a size limited by the frame size, as shown in Figure 8R. Item 536-2 is a next item from item 5736-1 within a sequence of items 5736. The sequence of items is, optionally, ordered by any suitable criterion or criteria, such as chronologically based on the date/time the image was taken or last modified, or alphabetically based on filename.

[00210] As contact 5742 continues to move laterally 5746, additional item(s) in the sequence of items 5736 are displayed. For example, Figure 8S shows preview 5737 of item 5736-3, which is a next item from item 5736-2 in the sequence, displayed in frame 5732-2 in

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response to detection of continued lateral movement 5744 of contact 5742. It should be appreciated that the "next" item described above is, optionally, a previous or a subsequent item in the sequence of items, depending on the lateral direction of the movement of contact 5742 across frame 5732-2.

[00211] Figure 8S also shows contact 5742 ceasing to substantially move on touch screen 112. While contact 5742 is substantially stationary on touch screen 112, an increase in the intensity of contact 5742 (e.g., from an intensity below IT_L to an intensity above IT_D) is detected, as shown in Figures 8S-8U. In response to detection of the increase in intensity of contact 5742, the size of preview 5737 of item 5736-3 is increased to a size larger than the frame size, as shown in Figure 8U.

[00212] While preview 5737 of item 5736-3 is displayed at the larger size, the intensity of contact 5742 is decreased (e.g., from an intensity above IT_D to an intensity below IT_L), as shown in Figure 8U-8W. In response to detection of the decrease in intensity of contact 5742, the size of preview 5737 of item 5736-3 is decreased back to the earlier size that was limited by the frame size, as shown in Figure 8W.

[00213] Figures 9A-9C are flow diagrams illustrating a method 5800 of previewing content in accordance with some embodiments. The method 5800 is performed at an electronic device (e.g., device 300, Figure 3, or portable multifunction device 100, Figure 1A) with a display and a touch-sensitive surface. In some embodiments, the display is a touch screen display and the touch-sensitive surface is on the display. In some embodiments, the display is separate from the touch-sensitive surface. Some operations in method 5800 are, optionally, combined and/or the order of some operations is, optionally, changed.

[00214] As described below, the method 5800 provides an intuitive way to preview content. The method reduces the cognitive burden on a user when previewing content, thereby creating a more efficient human-machine interface. For battery-operated electronic devices, enabling a user to preview content faster and more efficiently conserves power and increases the time between battery charges.

[00215] The device displays (5802) a frame for previewing content, where the frame corresponds to a plurality of content items (e.g., digital photographs, videos, or other images). In some embodiments, the device displays (5804) a plurality of frames for previewing content, where each frame of the plurality of frames corresponds to a different plurality of content items (e.g., each frame of the plurality of frames corresponds to an album or event

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including a plurality of photos or videos). For example, Figure 8A shows frames 5702 displayed in user interface 5700. Frame 5702-1 corresponds to content items 5704. Frame 5702-2 corresponds to content items 5706. Frame 5702-3 corresponds to content items 5708. Frame 5702-4 corresponds to content items 5710. As another example, Figure 8P shows frames 5732 displayed in user interface 5730. Frame 5732-1 corresponds to content items 5734. Frame 5732-2 corresponds to content items 5736. Frame 5732-3 corresponds to content items 5738. Frame 5732-4 corresponds to content items 5740.

[00216] The device detects (5806) movement of a contact (e.g., a finger contact) across the touch-sensitive surface. Figures 8B-8D, for example, shows movement 5715 and 5717 of contact 5716 detected on touch-sensitive surface 451. Figures 8Q-8S shows movement 5744 and 5746 of contact 5742 detected on touch screen 112. The device moves (5808) a focus selector (e.g., cursor 5712 in Figures 8A-8O or contact 5742 in Figures 8P-8W) across the frame in accordance with the movement of the contact across the touch-sensitive surface. In Figures 8B-8D, in response to movement 5715 and 5717 of contact 5716 on touch-sensitive surface 451, cursor 5712, positioned over frame 5702-2, is moved across frame 5702-2 in accordance with movement 5715 and 5717. In Figures 8Q-8S, in response to movement 5744 and 5746 of contact 5742 on touch screen 112, contact 5742 is detected as moving across frame 5732-2 in accordance with movement 5744 and 5746. In Figures 8P-8Q, the position of contact 5742 on touch screen 112 is an analogue to the position of a cursor on a separate touch-sensitive surface.

[00217] The device sequentially displays (5810), in the frame, previews of respective content items in the plurality of content items in accordance with the movement of the focus selector across the frame, wherein a size of the previews is constrained to a size of the frame (e.g., scanning through a chronologically organized set of photos from a beginning of the set to the end of the set where the left edge of the frame is mapped to the beginning of the set and the right side of the frame is mapped to the end of the set). In Figures 8B-8D, previews 5707 of items 5706-1, 5706-2 and 5706-3 are displayed in sequence in accordance with movement of cursor 5712 across frame 5702-2, where the sizes of previews 5707 is limited by the size of frame 5702-2. In Figures 8Q-8S, previews 5737 of items 5736-1, 5736-2 and 5736-3 are displayed in sequence in accordance with movement of contact 5742 across frame 5732-2, where the sizes of previews 5737 is limited by the size of frame 5732-2.

[00218] While a respective preview of a respective content item is displayed in the frame at a first size, the device detects (5812) an increase in intensity of the contact. For

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example, in Figures 8E-8G, while preview 5707 of item 5706-3 is displayed, an increase in the intensity of contact 5716 (e.g., from an intensity below IT_L in Figure 8E to an intensity above IT_D in Figure 8G) is detected. As another example, in Figure 8S-8U, while preview 5737 of item 5736-3 is displayed, an increase in the intensity of contact 5742 (e.g., from an intensity below IT_L in Figure 8S to an intensity above IT_D in Figure 8U) is detected.

[00219] In response to detecting the increase in intensity of the contact, the device increases (5814) the size of the respective preview to a second size larger than the size of the frame. Figure 8G, for example, shows preview 5707 of item 5706-3 increased to a size larger than the size of frame 5702-2 in response to detection of the increase in the intensity of contact 5716 (e.g., from an intensity below IT_L in Figure 8E to an intensity above IT_D in Figure 8G). As another example, Figure 8U shows preview 5737 of item 5736-3 increased to a size larger than the size of frame 5732-2 in response to detection of the increase in the intensity of contact 5742 (e.g., from an intensity below IT_L in Figure 8S to an intensity above IT_D in Figure 8U). While the frames in Figures 8B-8G and Figures 8Q-8U are shown as being substantially smaller than the display, in some situations the frames will be larger (e.g., a size corresponding to half or three quarters of the display) and the respective preview will have a correspondingly larger size that is, in some circumstances, a "full size" of the content – sometimes called a "native resolution" of the content. In such situations, the first size will correspond to a full size of the content, while the second size will correspond to an enlarged or "zoomed in" size of the content that is larger than the "full size" of the content.

[00220] In some embodiments, increasing the size of the respective preview includes (5816) displaying an animation of the respective preview increasing in size in accordance with the intensity of the contact (e.g., the respective preview increases in size at a rate based on the intensity of the contact, or the respective preview is enlarged to a size corresponding to the current intensity of the contact). For example, the increase in the size of preview 5707 from Figure 8E through Figure 8G is, optionally, animated, and the animation optionally follows the increase in the intensity of contact 5716, as shown in Figures 8E-8G.

[00221] While displaying the respective preview at the second size, the device detects (5818) a decrease in intensity of the contact. For example, Figure 8H shows detection of a decrease in the intensity of contact 5716 (e.g., from an intensity above IT_D in Figure 8H to an intensity below IT_L in Figure 8J) while preview 5707 of item 5706-3 is displayed at the larger size, and Figure 8V shows detection of a decrease in the intensity of contact 5742 (e.g., from

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an intensity above IT_D in Figure 8U to an intensity below IT_L in Figure 8W) while preview 5737 of item 5736-3 is displayed at the larger size.

[00222] In some embodiments, the contact is (5820) a single unbroken contact from a point in time when the movement of the contact across the touch-sensitive surface is detected to a point in time when the decrease in intensity of the contact is detected. For example, contact 5716 as depicted in Figures 8B-8H, from detection of movement 5715 to detection of the decrease in the intensity of contact 5716, is unbroken. Contact 5742 as depicted in Figures 8Q-8V, from detection of movement 5744 to detection of the decrease in the intensity of contact 5742, is unbroken.

[00223] In some embodiments, detecting the decrease in intensity of the contact includes (5822) detecting liftoff of the contact. For example, Figures 8H and 8K-8L show a liftoff of contact 5716 detected as a decrease in the intensity of contact 5716, and in response decreasing the size of preview 5707 of item 5706-3.

[00224] In some embodiments, detecting the decrease in intensity of the contact includes (5824) detecting a decrease in intensity of the contact while continuing to detect the contact on the touch-sensitive surface. Figures 8H-8J, for example, shows detection of the decrease in the intensity of contact 5716 (e.g., from an intensity above IT_D in Figure 8H to an intensity below IT_L in Figure 8J) while contact 5716 continues to be detected on touch-sensitive surface 451. Figures 8U-8W shows detection of the decrease in the intensity of contact 5742 (e.g., from an intensity above IT_D in Figure 8U to an intensity below IT_L in Figure 8W) while contact 5742 continues to be detected on touch screen 112.

[00225] In response to detecting the decrease in intensity of the contact, the device reduces (5826) the size of the respective preview to the first size. For example, Figure 8J shows preview 5707 of item 5706-3 reduced back to the size limited by the size of frame 5702-2 in response to detection of the decrease in intensity of contact 5716, and Figure 8W shows preview 5737 of item 5736-3 reduced back to the size limited by the size of frame 5732-2 in response to detection of the decrease in intensity of contact 5742.

[00226] In some embodiments, reducing the size of the respective preview includes (5828) displaying an animation of the respective preview decreasing in size in accordance with the intensity of the contact (e.g., the respective preview decreases in size at a rate based on the intensity of the contact, or the respective preview shrinks to a size corresponding to the current intensity of the contact). For example, the decrease in the size of preview 5707 from

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Figure 8H through Figure 8J is, optionally, animated, and the animation optionally follows the decrease in the intensity of contact 5716.

[00227] In some embodiments, the device detects (5830) additional movement of the contact corresponding to lateral movement of the focus selector on the display. For example, while cursor 5712 is positioned over frame 5702-2, contact 5716 optionally moves laterally, as in movement 5717 or 5718, as shown in Figures 8B-8D, 8M-8N.

[00228] In response (5832) to detecting the additional movement of the contact, in accordance with detecting the additional movement while displaying the respective preview at the first size (e.g., while the contact is below a respective intensity threshold), the device ceases (5834) to display the respective preview and sequentially displays, at the first size, previews of respective content items in the plurality of content items in accordance with the movement of the focus selector across the frame. For example, when cursor 5712 is moved across frame 5702-2 while preview 5707 of an item 5706 is displayed at a size limited by the frame size, previews of other items 5706 are displayed sequentially, as in the sequential display of previews of items 5706-1, 5706-2 and 5706-3 shown in Figures 8B-8D.

[00229] In contrast, in accordance with detecting the additional movement while displaying the respective preview at the second size (e.g., while the contact is above a respective intensity threshold), the device maintains (5836) display of the respective preview on the display. For example, when cursor 5712 is moved across frame 5702-2, in accordance with movement 5718 of contact 5716, while preview 5707 of item 5706-3 is displayed at the larger size (Figure 8M), display of preview 5707 at the larger size is, optionally, maintained, as shown in Figure 8N.

[00230] Alternatively, in accordance with detecting the additional movement while displaying the respective preview at the second size (e.g., while the contact is above a respective intensity threshold), the device ceases (5838) to display the respective preview and sequentially displays, at the second size, previews of respective content items in the plurality of content items in accordance with the movement of the focus selector across a region of the display corresponding to the frame (e.g., a region of the display that where the focus selector was displayed prior to the respective preview being enlarged to the second size). For example, in accordance with movement 5718 of contact 5716, preview 5707 of previous or subsequent items in the sequence, such as item 5706-2, is, optionally, displayed at the larger size, as shown in Figure 8O.

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[00231] It should be understood that the particular order in which the operations in Figures 9A-9C have been described is merely exemplary and is not intended to indicate that the described order is the only order in which the operations could be performed. One of ordinary skill in the art would recognize various ways to reorder the operations described herein. Additionally, it should be noted that details of other processes described herein with respect to other methods described herein (e.g., those listed in paragraph [0043]) are also applicable in an analogous manner to method 5800 described above with respect to Figures 9A-9C. For example, the contacts, intensity thresholds, focus selectors, animations described above with reference to method 5800 optionally have one or more of the characteristics of the contacts, intensity thresholds, focus selectors, animations described herein with reference to other methods described herein (e.g., those listed in paragraph [0043]). For brevity, these details are not repeated here.

[00232] In accordance with some embodiments, Figure 10 shows a functional block diagram of an electronic device 5900 configured in accordance with the principles of the various described embodiments. The functional blocks of the device are, optionally, implemented by hardware, software, or a combination of hardware and software to carry out the principles of the various described embodiments. It is understood by persons of skill in the art that the functional blocks described in Figure 10 are, optionally, combined or separated into sub-blocks to implement the principles of the various described embodiments. Therefore, the description herein optionally supports any possible combination or separation or further definition of the functional blocks described herein.

[00233] As shown in Figure 10, an electronic device 5900 includes a display unit 5902 configured to display a frame for previewing content, wherein the frame corresponds to a plurality of content items; a touch-sensitive surface unit 5904 configured to receive contacts; one or more sensor units 5905 configured to detect intensity of contacts with the touch-sensitive surface unit 5904; and a processing unit 5906 coupled to the display unit 5902, the touch-sensitive surface unit 5904, and the sensor units 5905. In some embodiments, the processing unit 5906 includes a detecting unit 5908, a moving unit 5910, a display enabling unit 5912, an increasing unit 5914, a reducing unit 5916, a ceasing unit 5918, and a maintaining unit 5920.

[00234] The processing unit 5906 is configured to detect movement of a contact across the touch-sensitive surface unit 5904 (e.g., with the detecting unit 5908); move a focus selector across the frame in accordance with the movement of the contact across the touch-

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sensitive surface unit 5904 (e.g., with the moving unit 5910); enable sequential display of, in the frame, previews of respective content items in the plurality of content items in accordance with the movement of the focus selector across the frame, wherein a size of the previews is constrained to a size of the frame (e.g., with the display enabling unit 5912); while a respective preview of a respective content item is displayed in the frame at a first size, detect an increase in intensity of the contact (e.g., with the detecting unit 5908); in response to detecting the increase in intensity of the contact, increase the size of the respective preview to a second size larger than the size of the frame (e.g., with the increasing unit 5914); while displaying the respective preview at the second size, detect a decrease in intensity of the contact (e.g., with the detecting unit 5908); and in response to detecting the decrease in intensity of the contact, reduce the size of the respective preview to the first size (e.g., with the reducing unit 5916).

[00235] In some embodiments, the contact is a single unbroken contact from a point in time when the movement of the contact across the touch-sensitive surface unit 5904 is detected to a point in time when the decrease in intensity of the contact is detected.

[00236] In some embodiments, detecting the decrease in intensity of the contact includes detecting liftoff of the contact.

[00237] In some embodiments, detecting the decrease in intensity of the contact includes detecting a decrease in intensity of the contact while continuing to detect the contact on the touch-sensitive surface unit 5904.

[00238] In some embodiments, the processing unit 5906 is configured to enable display of a plurality of frames for previewing content, wherein each frame of the plurality of frames corresponds to a different plurality of content items (e.g., with the display enabling unit 5912).

[00239] In some embodiments, increasing the size of the respective preview includes displaying an animation of the respective preview increasing in size in accordance with the intensity of the contact.

[00240] In some embodiments, reducing the size of the respective preview includes displaying an animation of the respective preview decreasing in size in accordance with the intensity of the contact.

[00241] In some embodiments, the processing unit 5906 is configured to: detect additional movement of the contact corresponding to lateral movement of the focus selector

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on the display unit 5902 (e.g., with the detecting unit 5908); and in response to detecting the additional movement of the contact: in accordance with detecting the additional movement while displaying the respective preview at the first size, cease to display the respective preview (e.g., with ceasing unit 5918) and enable sequential display of, at the first size, previews of respective content items in the plurality of content items in accordance with the movement of the focus selector across the frame (e.g., with the display enabling unit 5912); and in accordance with detecting the additional movement while displaying the respective preview at the second size, maintain display of the respective preview on the display (with the maintaining unit 5920).

[00242] In some embodiments, the processing unit 5906 is configured to: detect additional movement of the contact corresponding to lateral movement of the focus selector on the display unit 5902 (e.g., with the detecting unit 5908); and in response to detecting the additional movement of the contact: in accordance with detecting the additional movement while displaying the respective preview at the first size, cease to display the respective preview (e.g., with ceasing unit 5918) and enable sequential display of, at the first size, previews of respective content items in the plurality of content items in accordance with the movement of the focus selector across the frame (e.g., with the display enabling unit 5912); and in accordance with detecting the additional movement while displaying the respective preview at the second size, cease to display the respective preview (e.g., with ceasing unit 5918) and enable sequential display of, at the second size, previews of respective content items in the plurality of content items in accordance with the movement of the focus selector across a region of the display unit 5902 corresponding to the frame (e.g., with the display enabling unit 5912).

[00243] The operations in the information processing methods described above are, optionally implemented by running one or more functional modules in information processing apparatus such as general purpose processors (e.g., as described above with respect to Figures 1A and 3) or application specific chips.

[00244] The operations described above with reference to Figures 9A-9C are, optionally implemented by components depicted in Figures 1A-1B or Figure 10. For example, detection operations 5806, 5812, and 5818, moving operation 5808, displaying operation 5810, increasing operation 5814, and reducing operation 5826 are, optionally, implemented by event sorter 170, event recognizer 180, and event handler 190. Event monitor 171 in event sorter 170 detects a contact on touch screen 112, and event dispatcher

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module 174 delivers the event information to application 136-1. A respective event recognizer 180 of application 136-1 compares the event information to respective event definitions 186, and determines whether a first contact at a first location on the touch-sensitive surface (or whether rotation of the device) corresponds to a predefined event or sub-event, such as selection of an object on a user interface, or rotation of the device from one orientation to another. When a respective predefined event or sub-event is detected, event recognizer 180 activates an event handler 190 associated with the detection of the event or sub-event. Event handler 190 optionally utilizes or calls data updater 176 or object updater 177 to update the application internal state 192. In some embodiments, event handler 190 accesses a respective GUI updater 178 to update what is displayed by the application. Similarly, it would be clear to a person having ordinary skill in the art how other processes can be implemented based on the components depicted in Figures 1A-1B.

Displaying User Interface Objects Corresponding to an Application

[00245] At any one time, a user may have multiple windows for any one application opened, and not all of them are displayed. Some of these windows or documents are, optionally, minimized or hidden by other windows. Further, an application may have a recently opened documents history. In some methods, a user keeps track of the multiple windows by looking at a taskbar or opening a task list, both of which are, optionally, hidden at first. To look at a recently opened documents history for an application, the user has to open the application. These methods add additional steps for the user. The embodiments described below improve on these methods by providing a more efficient way to review currently opened windows and a history of recently opened documents. The user moves a focus selector over an application icon corresponding to the desired application and performs a gesture with a contact with an intensity that peaks above a threshold. In response, reduced-scale representations of currently opened windows for the application or of recently opened documents are displayed. Thus, the user is able to get a glance of currently opened windows and recently opened documents.

[00246] Figures 11A-11P illustrate exemplary user interfaces for displaying user interface objects corresponding to an application in accordance with some embodiments. The user interfaces in these figures are used to illustrate the processes described below, including the processes in Figures 12A-12B. Figures 11A-11P include intensity diagrams that show the current intensity of the contact on the touch-sensitive surface relative to a plurality of

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intensity thresholds including a light press intensity threshold (e.g., "IT_L") and a deep press intensity threshold (e.g., "IT_D"). In some embodiments, operations similar to those described below with reference to "IT_D" are performed with reference to "a different intensity threshold (e.g., "IT_L").

[00247] Figure 11A illustrates user interface 6000 (e.g., a graphical user interface desktop) displayed on display 450 (e.g., display 340) of a device (e.g., device 300). User interface 6000 includes one or more application icons 6002 displayed in predefined region 6004 (e.g., an application launch icon tray/dock/springboard) in user interface 6000. Each of application icons 6004 corresponds to a respective application. For example, application icon 6002-2 corresponds to the application "App 2," and application icon 6002-1 corresponds to the application "App 1." Cursor 6006 (for example, a mouse pointer) is also displayed in user interface 6000. Cursor 6006 is an example of a focus selector.

[00248] In Figure 11A, a gesture that includes a press input that corresponds to an increase in intensity of contact 6008 from an intensity below a light press intensity threshold (e.g., "IT_L") to an intensity above the light press intensity threshold (e.g., "IT_L") is detected on touch-sensitive surface 451 (e.g., touchpad 355, Figure 3) of the device while cursor 6006 is displayed over application icon 6002-2. One or more sensors for detecting the intensity of contacts on touch-sensitive surface 451 determine that the maximum intensity of contact 6008 during the press input is below a deep press intensity threshold (e.g., "IT_D"). The gesture ends with a reduction in intensity of contact 6008 below the light press intensity threshold (e.g., "IT_L"), as shown in Figure 11B. In some circumstances, the gesture ends with a liftoff of contact 6008.

[00249] In response to the detection of the gesture, and in accordance with contact 6008 having a maximum intensity below the deep press intensity threshold (e.g., "IT_D"), application window 6010 of App 2 is displayed when the end of the gesture is detected, as shown in Figure 11B. Application window 6010 corresponds to application App 2, which corresponds to application icon 6002-2. Application window 6010 is, optionally, a new application window for App 2 (e.g., App 2 had no open windows when the end of the gesture that is performed with contact 6008 is detected, and thus a new application window is opened).

[00250] Figure 11C illustrates application icons 6002, cursor 6006, etc. displayed in user interface 6000, as in Figure 11A. A gesture that includes a press input that corresponds

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to an increase in intensity of contact 6012 from an intensity below a deep press intensity threshold (e.g., "IT_D") to an intensity above the deep press intensity threshold (e.g., "IT_D") is detected on touch-sensitive surface 451 while cursor 6006 is displayed over application icon 6002-2. The sensors for detecting the intensity of contacts on touch-sensitive surface 451 determine that the intensity of contact 6012 during the press input goes above the deep press intensity threshold (e.g., "IT_D"). The gesture ends with a reduction in intensity of contact 6012 below the light press intensity threshold (e.g., "IT_L"), as shown in Figure 11D. In some circumstances, the gesture ends with a liftoff of contact 6012. In response to the detection of gesture, and in accordance with contact 6012 having an intensity that goes above the deep press intensity threshold (e.g., "IT_D")during the gesture, one or more user interface objects corresponding to App 2 are displayed when the end of the gesture is detected. In some embodiments, the user interface objects are reduced-scale representations 6014 (e.g., thumbnails) of currently open (doesn't have to be currently displayed) application windows for App 2, as shown in Figure 11D. The user optionally moves cursor 6006 to a position over one of these reduced-scale representations 6014 and perform a gesture (for example, a tap gesture) on touch-sensitive surface 451 to select the reduced-scale representation 6014 over which cursor 6006 is positioned. In response to the detection of that gesture corresponding to selection of one of the reduced-scale representations 6014, the application window corresponding to the selected reduced-scale representation is displayed on display 450.

[00251] In some embodiments, the user interface objects that are displayed in accordance with the contact having an intensity that was above the predefined threshold are reduced-scale representations of recently opened documents for the application, instead of reduced-scale representations of currently open application windows such as representations 6014. As used herein, documents include images, text documents, word processor documents, spreadsheets, presentations, drawings, video clips, audio clips, and so on. Also, in some embodiments, the user interface objects are, optionally, displayed during the gesture, while the contact is still detected on touch-sensitive surface 451, instead of being displayed when the end of the gesture is detected (with liftoff of the contact or a reduction in intensity of the contact below IT_L), as in Figure 11D. For example, Figure 11E illustrates application icons 6002, cursor 6006, etc. displayed in user interface 6000, as in Figure 11A. Figures 11E-11H illustrate detection of a gesture that includes a press input that corresponds to an increase in intensity of contact 6016 from an intensity below a light press intensity threshold (e.g., "IT_L") in Figure 11E to an intensity above a deep press intensity threshold (e.g., "IT_D") in Figure

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11H. The gesture performed with contact 6016 is detected on touch-sensitive surface 451 while cursor 6006 is displayed over application icon 6002-2 corresponding to App 2. The sensors for detecting the intensity of contacts on touch-sensitive surface 451 determine that the intensity of contact 6016 peaked above the deep press intensity threshold (e.g., "IT_D"). Contact 6016 is maintained on touch-sensitive surface 451. In response to the detection of the gesture, and in accordance with contact 6016 having an intensity that goes above the deep press intensity threshold (e.g., "IT_D") during the gesture, reduced-scale representations 6018 (e.g., thumbnails) of recently opened documents for App 2 are displayed, as shown in Figures 11F-11H.

[00252] In some embodiments, the display of representations 6018 includes an animation. For example, initially representation 6018-1 is displayed in proximity of application icon 6002-2, as shown in Figure 11F. As the animation proceeds, representation 6018-1 moves upward and representation 6018-2 is displayed in proximity of application icon 6002-2, as shown in Figure 11G. Then representations 6018-1 moves upward, 6018-2 move upward toward representation 6018-1, and representation 6018-3 is displayed in proximity of application icon 6002-2, as shown in Figure 11H. Representations 6018-1 thru 6018-3 form an array above icon 6002-2. In some embodiments, the animation progresses in accordance with an intensity of contact 6016, as shown in Figures 11F-11G, where the representations 6018 appear and move upwards as the intensity of contact 6016 increases toward the deep press intensity threshold (e.g., "IT_D").

[00253] The user optionally moves cursor 6006 to a position over one of these reduced-scale representations 6018 and performs a gesture (for example, a tap gesture) on touch-sensitive surface 451 to select the reduced-scale representation 6018 over which cursor 6006 is positioned. In response to that gesture, the document corresponding to the selected representation 6018 is opened and displayed on display 450 in an application window for App 2 (the application corresponding to icon 6002-2).

[00254] In some embodiments, user interface objects corresponding to an application, such as reduced-scale representations of application windows or recently opened documents, are, optionally, displayed in predefined region 6004 (e.g., an application launch region such as an application dock). Figures 11I-11L illustrate detection of a gesture that includes a press input that corresponds to an increase in intensity of contact 6020 from an intensity below a light press intensity threshold (e.g., "IT_L") in Figure 11I to an intensity above a deep press intensity threshold (e.g., "IT_D") in Figure 11L. The gesture performed with contact 6020 is

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detected on touch-sensitive surface 451 while cursor 6006 is displayed over application icon 6002-2 corresponding to App 2. The sensors for detecting the intensity of contacts on touch-sensitive surface 451 determine that the intensity of contact 6020 peaked above the deep press intensity threshold (e.g., "IT_D"). Contact 6020 is maintained on touch-sensitive surface 451. In response to the detection of the gesture, and in accordance with contact 6020 having an intensity that goes above the deep press intensity threshold (e.g., "IT_D") during the gesture, reduced-scale representations 6022 (e.g., thumbnails) of recently opened documents for App 2 are displayed, as shown in Figures 11J-11L.

[00255] In some embodiments, the display of representations 6022 includes an animation. For example, icons 6002 are animated in a way that give an illusion of shifting backwards into display 450. With icons 6002 shifted backward, representation 6022-4 is displayed in predefined region 6004 in proximity of application icon 6002-2, as shown in Figure 11J. As the animation proceeds, representation 6022-4 moves toward the right end of predefined region 6004 and representation 6022-3 is displayed in predefined region 6004 in proximity of application icon 6002-2, as shown in Figure 11K. Then representations 6022-3 moves toward representation 6022-4, and the other representations 6022-2 and 6022-1 are displayed in predefined region 6004 in a similar manner. The animation ends with representations 6022 displayed in region 6004 in front of application icons 6002, as shown in Figure 11L. In some embodiments, the animation progresses in accordance with an intensity of contact 6020, as shown in Figures 11I-11L, where the representations 6022 appear and move along the predefined region 6004 as the intensity of contact 6016 increases toward the deep press intensity threshold (e.g., "IT_D").

[00256] It should be appreciated that the ways in which the user interface objects are displayed, as described above with reference to Figures 11A-11L, are merely exemplary. The user interface objects are, optionally, displayed in other sizes, positions, and so on.

[00257] Figures 11M-11P illustrate an example of the user interfaces described above, with reference to Figures 11A-11L, implemented on a device (e.g., device 100) with a touch-sensitive display (e.g., touch screen 112). Figure 11M illustrates user interface 6030 (e.g., a graphical user interface desktop) displayed on touch screen 112 of a device (e.g., device 100). User interface 6030 includes one or more application icons 6032 displayed in predefined region 6034 (e.g., an application launch icon tray/dock/springboard) in user interface 6030. In some embodiments, each of application icons 6034 corresponds to a respective application.

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For example, application icon 6032-2 corresponds to the application "App 2," and application icon 6032-1 corresponds to the application "App 1."

[00258] In Figure 11M, a gesture that includes a press input that corresponds to an increase in intensity of contact 6038 from an intensity below a light press intensity threshold (e.g., "IT_L") to an intensity above the light press intensity threshold (e.g., "IT_L") is detected on touch-sensitive display 112 of the device at a location corresponding to application icon 6032-2. One or more sensors for detecting the intensity of contacts on touch-sensitive display 112 determine that the maximum intensity of contact 6038 during the press input is below the deep press intensity threshold (e.g., "IT_D"). The gesture ends with a reduction in intensity of contact 6038 below the light press intensity threshold (e.g., "IT_L"), as shown in Figure 11N. In some circumstances, the gesture ends with a liftoff of contact 6038.

[00259] In response to the detection of the gesture, and in accordance with contact 6038 having a maximum intensity below the deep press intensity threshold (e.g., "IT_D"), application window 6040 of App 2 is displayed when the end of the gesture is detected. Application window 6040 corresponds to application App 2, which corresponds to application icon 6032-2. Application window 6040 is, optionally, a new application window for App 2 (e.g., App 2 had no open windows when the end of the gesture performed with contact 6038 is detected, and thus a new application window is opened).

[00260] Figure 11O illustrates application icons 6032, etc. displayed in user interface 6030, as in Figure 11M. A gesture that includes a press input that corresponds to an increase in intensity of contact 6042 from an intensity below a deep press intensity threshold (e.g., "IT_D") to an intensity above the deep press intensity threshold (e.g., "IT_D") is detected on touch-sensitive display 112 at a location corresponding to application icon 6032-2. The sensors for detecting the intensity of contacts on touch-sensitive display 112 determine that the intensity of contact 6042 during the press input goes above the deep press intensity threshold (e.g., "IT_D"). The gesture ends with a reduction in intensity of contact 6042 below the light press intensity threshold (e.g., "IT_L"), as shown in Figure 11P. In some circumstances, the gesture ends with a liftoff of contact 6042.

[00261] In response to the detection of gesture, and in accordance with contact 6042 having an intensity that goes above the deep press intensity threshold (e.g., "IT_D") during the gesture, one or more user interface objects corresponding to App 2 are displayed when the end of the gesture is detected. In some embodiments, the user interface objects are reduced-

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scale representations 6044 (e.g., thumbnails) of currently open (doesn't have to be currently displayed) application windows for App 2, as shown in Figure 11P. The user optionally performs a gesture (e.g., a tap gesture) on touch-sensitive display 112 at a location corresponding to one of these reduced-scale representations 6044 to select the reduced-scale representation 6044 over which the gesture is performed. In response to the detection of that gesture corresponding to selection of one of the reduced-scale representations 6044, the application window corresponding to the selected reduced-scale representation is displayed on touch-sensitive display 112.

[00262] Figures 12A-12B are flow diagrams illustrating a method 6100 of displaying user interface objects corresponding to an application in accordance with some embodiments. The method 6100 is performed at an electronic device (e.g., device 300, Figure 3, or portable multifunction device 100, Figure 1A) with a display and a touch-sensitive surface. In some embodiments, the display is a touch screen display and the touch-sensitive surface is on the display. In some embodiments, the display is separate from the touch-sensitive surface. Some operations in method 6100 are, optionally, combined and/or the order of some operations is, optionally, changed.

[00263] As described below, the method 6100 provides an intuitive way to display user interface objects corresponding to an application. The method reduces the cognitive burden on a user when displaying user interface objects corresponding to an application, thereby creating a more efficient human-machine interface. For battery-operated electronic devices, enabling a user to display user interface objects corresponding to an application faster and more efficiently conserves power and increases the time between battery charges.

[00264] The device displays (6102) a plurality of application icons, where the plurality of application icons includes a respective application icon corresponding to a respective application. Figures 11A-11L show, for example, application icons 6002 displayed on display 450. Application icon 6002-2 corresponds to application "App 2." As another example, Figures 11M-11P show application icons 6032 displayed on touch-sensitive display 112. Application icon 6032-2 corresponds to application "App 2."

[00265] While a focus selector (e.g., cursor 6006 in Figure 11A or contact 6038 in Figure 11M) is over the respective application icon, the device detects (6104) a gesture that includes a contact (e.g., a finger contact) on the touch-sensitive surface. As shown in Figure 11A, for example, a gesture that includes contact 6008 is detected on touch-sensitive surface

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451 while cursor 6006 is over application icon 6002-2. As another example, in Figure 11C, a gesture that includes contact 6012 is detected on touch-sensitive surface 451 while cursor 6006 is over application icon 6002-2. In Figure 11M, a gesture that includes contact 6038 is detected on touch-sensitive display 112 at a location over application icon 6032-2.

[00266] In response to detecting the gesture (6106), in accordance with a determination that the contact had a maximum intensity during the gesture that was below a respective intensity threshold (e.g., "IT_D"), the device displays (6108) an application window of the respective application. For example, in Figure 11A, contact 6008 is determined to have a maximum intensity during the gesture that is below the deep press intensity threshold (e.g., "IT_D"). In accordance with that determination, in response to detecting the gesture performed with contact 6008, application window 6010 of App 2 is displayed, as shown in Figure 11B. In some embodiments, the application window is a new application window that was not displayed on the display prior to detecting the contact (e.g., the new application window was not displayed on the display immediately prior to detecting the contact) (6110). For example, the new application window is an application window that was created by the application in response to detecting the gesture. For example, when a user opens a web browser, a new browser window is typically opened. Similarly, when a user opens a word processing application, a blank word processing document is typically opened. As another example, when a user requests that an image be opened, a new window including the image is typically opened. For example, application window 6010 (Figure 11B) or 6040 (Figure 11N) is, optionally, new application window if there were no open (displayed or not) windows for App 2 prior to detection of the gesture performed with contact 6008 or 6038, respectively.

[00267] In contrast, in accordance with a determination that the contact reached an intensity during the gesture that was above the respective intensity threshold (e.g., "IT_D"), the device displays (6112) a plurality of user interface objects that correspond to the respective application. In Figure 11C, the intensity of contact 6012 is determined to have reached above the deep press intensity threshold (e.g., "IT_D") during the gesture. In accordance with that determination, in response to detecting the gesture performed with contact 6012, one or more user interface objects corresponding to App 2 (e.g., reduced-scale representations 6014 of application windows for App 2) are displayed, as shown in Figure 11D. As another example, reduced-scale representations 6018 (Figure 11H) or 6022 (Figure 11L) of recently opened documents for App 2 are also examples of user interface objects displayed in response to

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detection of a gesture that includes a contact (e.g., contact 6016, Figure 11E; contact 6020, Figure 11I) with an intensity that goes above the deep press intensity threshold (e.g., "IT_D").

[00268] As another example, in Figure 11M, contact 6038 is determined to have a maximum intensity during the gesture that is below deep press intensity threshold (e.g., "IT_D"). In accordance with that determination, in response to detecting the gesture performed with contact 6038, application window 6040 of App 2 is displayed, as shown in Figure 11N. In Figure 11O, the intensity of contact 6042 is determined to have reached above the deep press intensity threshold (e.g., "IT_D") during the gesture. In accordance with that determination, in response to detecting the gesture performed with contact 6042, one or more user interface objects corresponding to App 2 (e.g., reduced-scale representations 6044 of application windows for App 2) are displayed, as shown in Figure 11P.

[00269] In some embodiments, the plurality of user interface objects includes (6114) reduced-scale representations of currently open application windows for the application. (e.g., thumbnail images of the currently open application windows). For example, the user interface objects displayed in response to the detection of the gesture performed with contact 6012 are reduced-scale representations 6014 of currently open application windows for App 2 (Figure 11D). As another example, the user interface objects displayed in response to the detection of the gesture performed with contact 6042 are reduced-scale representations 6044 of currently open application windows for App 2 (Figure 11P). In some embodiments, the plurality of user interface objects include (6116) reduced-scale representations of recently opened documents for the respective application. (e.g., thumbnails of the first page or the current page of the recently opened documents). For example, the user interface objects displayed in response to the detection of the gesture performed with contact 6016 are reduced-scale representations 6018 of recently opened documents for App 2 (Figure 11H).

[00270] In some embodiments, the plurality of application icons are displayed (6118) in a predefined region of the display (e.g., an application launch icon tray/dock/springboard) prior to detecting the gesture, and the plurality of user interface objects are displayed in the predefined region of the display. Application icons 6002 in Figures 11I-11L, for example, are displayed in predefined region 6004 prior to detection of a contact on touch-sensitive surface 451, and the user interface objects that correspond to the respective application(for example, representations 6022, Figure 11L) are, optionally, displayed in predefined region 6004 as well. In some embodiments, the plurality of user interface objects are displayed (6120) in front of and at least partially overlapping one or more of the plurality of application icons in

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the predefined region of the display. For example, reduced-scale representations 6022 that correspond to the respective application (e.g., App 2 in Figure 11L) are displayed in front of and partially overlapping application icons 6002.

[00271] In some embodiments, displaying the plurality of user interface objects corresponding to the respective application includes (6122) displaying an animation of the plurality of application icons shifting backward into the display (e.g., show the plurality of application icons getting smaller with a change in shading and position to provide the illusion that the application icons are moving backward into the display), and displaying the plurality of user interface objects corresponding to the respective application in a location on the display previously occupied by the plurality of application icons (e.g., display the user interface objects in front of the plurality of application icons). For example, Figures 11J-11L show instances in an animation of application icons 6002 shifting backwards and representations 6022 being displayed in the area that were occupied by application icons 6002.

[00272] In some embodiments, displaying the plurality of user interface objects corresponding to the respective application includes (6124), for a respective user interface object associated with the respective application, initially displaying the respective user interface object at a location proximate to the respective application icon (e.g., the respective user interface object appears near the respective application icon), and after initially displaying the respective user interface object, displaying an animation of the respective user interface object moving from the location proximate to the respective application icon to a location proximate to another user interface object in the plurality of user interface objects (e.g., after appearing near the respective application icon, the respective user interface object moves towards other previously displayed user interface objects). For example, successive thumbnails of recently opened documents appear near the application icon for the application to which they correspond and then move (e.g., fly over) to form an array of thumbnails in a predefined region of the display (e.g., the dock). For example, Figure 11K shows representation 6022-3 displayed near application icon 6002-2. Representation 6022-3 moves toward representation 6022-4 and ends up near representation 6022-4, as shown in Figure 11L.

[00273] In some embodiments, the application window of the respective application is displayed (6126) when an end of the gesture is detected (e.g., the application window is initially displayed immediately after detecting liftoff of the contact), and the plurality of user

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interface objects corresponding to the respective application are displayed during the gesture in response to detecting that the intensity of the contact exceeds the respective intensity threshold (e.g., the plurality of objects are initially displayed while still detecting the contact on the touch-sensitive surface). For example, application window 6010 in Figure 11B is, optionally, displayed when contact 6008 is lifted off, and representations 6018 are displayed while contact 6016 is still detected on touch-sensitive surface 451 as shown in Figure 11H.

[00274] In some embodiments, the application window of the respective application is displayed (6128) when an end of the gesture is detected (e.g., the application window is initially displayed immediately after detecting liftoff of the contact), and the plurality of user interface objects corresponding to the respective application are displayed when the end of the gesture is detected (e.g., the plurality of objects is initially displayed immediately after detecting liftoff of the contact). For example, application window 6010 in Figure 11B is, optionally, displayed when contact 6008 is lifted off, and representations 6014 in Figure 11D are, optionally, displayed when liftoff of contact 6012 is detected.

[00275] It should be understood that the particular order in which the operations in Figures 12A-12B have been described is merely exemplary and is not intended to indicate that the described order is the only order in which the operations could be performed. One of ordinary skill in the art would recognize various ways to reorder the operations described herein. Additionally, it should be noted that details of other processes described herein with respect to other methods described herein (e.g., those listed in paragraph [0043]) are also applicable in an analogous manner to method 6100 described above with respect to Figures 12A-12B. For example, the contacts, gestures, user interface objects, intensity thresholds, focus selectors, animations described above with reference to method 6100 optionally has one or more of the characteristics of the contacts, gestures, user interface objects, intensity thresholds, focus selectors, animations described herein with reference to other methods described herein (e.g., those listed in paragraph [0043]). For brevity, these details are not repeated here.

[00276] In accordance with some embodiments, Figure 13 shows a functional block diagram of an electronic device 6200 configured in accordance with the principles of the various described embodiments. The functional blocks of the device are, optionally, implemented by hardware, software, or a combination of hardware and software to carry out the principles of the various described embodiments. It is understood by persons of skill in the art that the functional blocks described in Figure 13 are, optionally, combined or

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separated into sub-blocks to implement the principles of the various described embodiments. Therefore, the description herein optionally supports any possible combination or separation or further definition of the functional blocks described herein.

[00277] As shown in Figure 13, an electronic device 6200 includes a display unit 6202 configured to display a plurality of application icons, where the plurality of application icons include a respective application icon corresponding to a respective application; a touch-sensitive surface unit 6204 configured to receive gestures including contacts; one or more sensor units 6205 configured to detect intensity of contacts with the touch-sensitive surface unit 6204; and a processing unit 6206 coupled to the display unit 6202, the touch-sensitive surface unit 6204 and the sensor units 6205. In some embodiments, the processing unit 6206 includes a detecting unit 6208, and a display enabling unit 6210.

[00278] The processing unit 6206 is configured to: while a focus selector is over the respective application icon, detect a gesture that includes a contact on the touch-sensitive surface unit 6204 (e.g., with the detecting unit 6208); and in response to detecting the gesture: in accordance with a determination that the contact had a maximum intensity during the gesture that was below a respective intensity threshold, enable display of an application window of the respective application (e.g., with the display enabling unit 6210); and in accordance with a determination that the contact reached an intensity during the gesture that was above the respective intensity threshold, enable display of a plurality of user interface objects that correspond to the respective application (e.g., with the display enabling unit 6210).

[00279] In some embodiments, the application window of the respective application is displayed when an end of the gesture is detected; and the plurality of user interface objects corresponding to the respective application are displayed during the gesture in response to detecting that the intensity of the contact exceeds the respective intensity threshold.

[00280] In some embodiments, the application window of the respective application is displayed when an end of the gesture is detected; and the plurality of user interface objects corresponding to the respective application are displayed when the end of the gesture is detected.

[00281] In some embodiments, the plurality of user interface objects includes reduced-scale representations of currently open application windows for the application.

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[00282] In some embodiments, the plurality of user interface objects includes reduced-scale representations of recently opened documents for the respective application.

[00283] In some embodiments, the plurality of application icons are displayed in a predefined region of the display unit 6202 prior to detecting the gesture; and the plurality of user interface objects are displayed in the predefined region of the display unit 6202.

[00284] In some embodiments, the plurality of user interface objects are displayed in front of and at least partially overlapping one or more of the plurality of application icons in the predefined region of the display unit 6202.

[00285] In some embodiments, enabling display of the plurality of user interface objects corresponding to the respective application includes: enabling display of an animation of the plurality of application icons shifting backward into the display unit 6202 (e.g., with the display enabling unit 6210); and enabling display of the plurality of user interface objects corresponding to the respective application in a location on the display unit 6202 previously occupied by the plurality of application icons (e.g., with the display enabling unit 6210).

[00286] In some embodiments, enabling display of the plurality of user interface objects corresponding to the respective application includes, for a respective user interface object associated with the respective application: initially enabling display of the respective user interface object at a location proximate to the respective application icon (e.g., with the display enabling unit 6210); and after initially enabling display of the respective user interface object, enabling display of an animation of the respective user interface object moving from the location proximate to the respective application icon to a location proximate to another user interface object in the plurality of user interface objects (e.g., with the display enabling unit 6210).

[00287] In some embodiments, the application window is a new application window that was not displayed on the display unit 6202 prior to detecting the contact.

[00288] The operations in the information processing methods described above are, optionally implemented by running one or more functional modules in information processing apparatus such as general purpose processors (e.g., as described above with respect to Figures 1A and 3) or application specific chips.

[00289] The operations described above with reference to Figures 6A-6B are, optionally, implemented by components depicted in Figures 1A-1B or Figure 13. For example, detection operation 6104, and displaying operations 6108 and 6112 are, optionally,

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implemented by event sorter 170, event recognizer 180, and event handler 190. Event monitor 171 in event sorter 170 detects a contact on touch-sensitive display 112, and event dispatcher module 174 delivers the event information to application 136-1. A respective event recognizer 180 of application 136-1 compares the event information to respective event definitions 186, and determines whether a first contact at a first location on the touch-sensitive surface corresponds to a predefined event or sub-event, such as selection of an object on a user interface. When a respective predefined event or sub-event is detected, event recognizer 180 activates an event handler 190 associated with the detection of the event or sub-event. Event handler 190 optionally utilizes or calls data updater 176 or object updater 177 to update the application internal state 192. In some embodiments, event handler 190 accesses a respective GUI updater 178 to update what is displayed by the application. Similarly, it would be clear to a person having ordinary skill in the art how other processes can be implemented based on the components depicted in Figures 1A-1B.

[00290] It should be understood that the particular order in which the operations have been described above is merely exemplary and is not intended to indicate that the described order is the only order in which the operations could be performed. One of ordinary skill in the art would recognize various ways to reorder the operations described herein. Additionally, it should be noted that the various processes separately described herein (e.g., those listed in paragraph [0043]) can be combined with each other in different arrangements. For example, the contacts, user interface objects, tactile sensations, intensity thresholds, and/or focus selectors described above with reference to any one of the various processes separately described herein (e.g., those listed in paragraph [0043]) optionally have one or more of the characteristics of the contacts, gestures, user interface objects, tactile sensations, intensity thresholds, and focus selectors described herein with reference to one or more of the other methods described herein (e.g., those listed in paragraph [0043]). For brevity, all of the various possible combinations are not specifically enumerated here, but it should be understood that the claims described above may be combined in any way that is not precluded by mutually exclusive claim features.

[00291] The foregoing description, for purpose of explanation, has been described with reference to specific embodiments. However, the illustrative discussions above are not intended to be exhaustive or to limit the various described embodiments to the precise forms disclosed. Many modifications and variations are possible in view of the above teachings.

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The embodiments were chosen and described in order to best explain the principles of the various described embodiments and their practical applications, to thereby enable others skilled in the art to best utilize the various described embodiments with various modifications as are suited to the particular use contemplated.

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What is claimed is:

1. A method, comprising:

at an electronic device with a touch-sensitive surface and a display, wherein the device includes one or more sensors to detect intensity of contacts with the touch-sensitive surface:

displaying a plurality of application icons, wherein the plurality of application icons includes a respective application icon corresponding to a respective application;

while a focus selector is over the respective application icon, detecting a gesture that includes a contact on the touch-sensitive surface; and

in response to detecting the gesture:

in accordance with a determination that the contact had a maximum intensity during the gesture that was below a respective intensity threshold, displaying an application window of the respective application; and

in accordance with a determination that the contact reached an intensity during the gesture that was above the respective intensity threshold, displaying a plurality of user interface objects that correspond to the respective application.

2. The method of claim 1, wherein:

the application window of the respective application is displayed when an end of the gesture is detected; and

the plurality of user interface objects corresponding to the respective application are displayed during the gesture in response to detecting that the intensity of the contact exceeds the respective intensity threshold.

3. The method of claim 1, wherein:

the application window of the respective application is displayed when an end of the gesture is detected; and

the plurality of user interface objects corresponding to the respective application are displayed when the end of the gesture is detected.

4. The method of any of claims 1-3, wherein the plurality of user interface objects includes reduced-scale representations of currently open application windows for the application.

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5. The method of any of claims 1-4, wherein the plurality of user interface objects includes reduced-scale representations of recently opened documents for the respective application.

6. The method of any of claims 1-5, wherein:

the plurality of application icons are displayed in a predefined region of the display prior to detecting the gesture; and

the plurality of user interface objects are displayed in the predefined region of the display.

7. The method of claim 6, wherein the plurality of user interface objects are displayed in front of and at least partially overlapping one or more of the plurality of application icons in the predefined region of the display.

8. The method of any of claims 1-7, wherein, displaying the plurality of user interface objects corresponding to the respective application includes:

displaying an animation of the plurality of application icons shifting backward into the display; and

displaying the plurality of user interface objects corresponding to the respective application in a location on the display previously occupied by the plurality of application icons.

9. The method of any of claims 1-8, wherein displaying the plurality of user interface objects corresponding to the respective application includes, for a respective user interface object associated with the respective application:

initially displaying the respective user interface object at a location proximate to the respective application icon; and

after initially displaying the respective user interface object, displaying an animation of the respective user interface object moving from the location proximate to the respective application icon to a location proximate to another user interface object in the plurality of user interface objects.

10. The method of any of claims 1-9, wherein the application window is a new application window that was not displayed on the display prior to detecting the contact.

11. An electronic device, comprising:

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a display;

a touch-sensitive surface;

one or more sensors to detect intensity of contacts with the touch-sensitive surface;

one or more processors;

memory; and

one or more programs, wherein the one or more programs are stored in the memory and configured to be executed by the one or more processors, the one or more programs including instructions for:

displaying a plurality of application icons, wherein the plurality of application icons include a respective application icon corresponding to a respective application;

while a focus selector is over the respective application icon, detecting a gesture that includes a contact on the touch-sensitive surface; and

in response to detecting the gesture:

in accordance with a determination that the contact had a maximum intensity during the gesture that was below a respective intensity threshold, displaying an application window of the respective application; and

in accordance with a determination that the contact reached an intensity during the gesture that was above the respective intensity threshold, displaying a plurality of user interface objects that correspond to the respective application.

12. A computer readable storage medium storing one or more programs, the one or more programs comprising instructions, which when executed by an electronic device with a display, a touch-sensitive surface and one or more sensors to detect intensity of contacts with the touch-sensitive surface, cause the device to:

display a plurality of application icons, wherein the plurality of application icons include a respective application icon corresponding to a respective application;

while a focus selector is over the respective application icon, detect a gesture that includes a contact on the touch-sensitive surface; and

in response to detecting the gesture:

in accordance with a determination that the contact had a maximum intensity during the gesture that was below a respective intensity threshold, display an application window of the respective application; and

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in accordance with a determination that the contact reached an intensity during the gesture that was above the respective intensity threshold, display a plurality of user interface objects that correspond to the respective application.

13. A graphical user interface on an electronic device with a display, a touch-sensitive surface and one or more sensors to detect intensity of contacts with the touch-sensitive surface, a memory, and one or more processors to execute one or more programs stored in the memory, the graphical user interface comprising:

a plurality of application icons, wherein the plurality of application icons include a respective application icon corresponding to a respective application;

wherein:

in response to detection of a gesture that includes a contact on the touch-sensitive surface while a focus selector is over the respective application icon

in accordance with a determination that the contact had a maximum intensity during the gesture that was below a respective intensity threshold, an application window of the respective application is displayed; and

in accordance with a determination that the contact reached an intensity during the gesture that was above the respective intensity threshold, a plurality of user interface objects that correspond to the respective application is displayed.

14. An electronic device, comprising:

a display;

a touch-sensitive surface;

one or more sensors to detect intensity of contacts with the touch-sensitive surface; and

means for displaying a plurality of application icons, wherein the plurality of application icons include a respective application icon corresponding to a respective application;

means for, while a focus selector is over the respective application icon, detecting a gesture that includes a contact on the touch-sensitive surface; and

means, responsive to detecting the gesture, for:

in accordance with a determination that the contact had a maximum intensity during the gesture that was below a respective intensity threshold, displaying an application window of the respective application; and

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in accordance with a determination that the contact reached an intensity during the gesture that was above the respective intensity threshold, displaying a plurality of user interface objects that correspond to the respective application.

15. An information processing apparatus for use in an electronic device with a display, a touch-sensitive surface and one or more sensors to detect intensity of contacts with the touch-sensitive surface, comprising:

means for displaying a plurality of application icons, wherein the plurality of application icons include a respective application icon corresponding to a respective application;

means for, while a focus selector is over the respective application icon, detecting a gesture that includes a contact on the touch-sensitive surface; and

means, responsive to detecting the gesture, for:

in accordance with a determination that the contact had a maximum intensity during the gesture that was below a respective intensity threshold, displaying an application window of the respective application; and

in accordance with a determination that the contact reached an intensity during the gesture that was above the respective intensity threshold, displaying a plurality of user interface objects that correspond to the respective application.

16. An electronic device, comprising:

a display;

a touch-sensitive surface;

one or more sensors to detect intensity of contacts with the touch-sensitive surface;

one or more processors;

memory; and

one or more programs, wherein the one or more programs are stored in the memory and configured to be executed by the one or more processors, the one or more programs including instructions for performing any of the methods of claims 1-10.

17. A computer readable storage medium storing one or more programs, the one or more programs comprising instructions, which when executed by an electronic device with a display, a touch-sensitive surface and one or more sensors to detect intensity of contacts with the touch-sensitive surface, cause the device to perform any of the methods of claims 1-10.

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18. A graphical user interface on an electronic device with a display, a touch-sensitive surface, one or more sensors to detect intensity of contacts with the touch-sensitive surface, a memory, and one or more processors to execute one or more programs stored in the memory, the graphical user interface comprising user interfaces displayed in accordance with any of the methods of claims 1-10.

19. An electronic device, comprising:

a display;

a touch-sensitive surface;

one or more sensors to detect intensity of contacts with the touch-sensitive surface; and

means for performing any of the methods of claims 1-10.

20. An information processing apparatus for use in an electronic device with a display, a touch-sensitive surface and one or more sensors to detect intensity of contacts with the touch-sensitive surface, comprising:

means for performing any of the methods of claims 1-10.

21. An electronic device, comprising:

a display unit configured to display a plurality of application icons, wherein the plurality of application icons include a respective application icon corresponding to a respective application;

a touch-sensitive surface unit configured to receive gestures, the gestures including contacts on the touch-sensitive surface unit;

one or more sensors units configured to detect intensity of contacts with the touch-sensitive surface unit; and

a processing unit coupled to the display unit, the touch-sensitive surface unit and the sensor units, the processing unit configured to:

while a focus selector is over the respective application icon, detect a gesture that includes a contact on the touch-sensitive surface unit; and

in response to detecting the gesture:

in accordance with a determination that the contact had a maximum intensity during the gesture that was below a respective intensity threshold, enable display of an application window of the respective application; and

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in accordance with a determination that the contact reached an intensity during the gesture that was above the respective intensity threshold, enable display of a plurality of user interface objects that correspond to the respective application.

22. The electronic device of claim 21, wherein:

the application window of the respective application is displayed when an end of the gesture is detected; and

the plurality of user interface objects corresponding to the respective application are displayed during the gesture in response to detecting that the intensity of the contact exceeds the respective intensity threshold.

23. The electronic device of claim 21, wherein:

the application window of the respective application is displayed when an end of the gesture is detected; and

the plurality of user interface objects corresponding to the respective application are displayed when the end of the gesture is detected.

24. The electronic device of any of claims 21-23, wherein the plurality of user interface objects includes reduced-scale representations of currently open application windows for the application.

25. The electronic device of any of claims 21-24, wherein the plurality of user interface objects includes reduced-scale representations of recently opened documents for the respective application.

26. The electronic device of any of claims 21-25, wherein:

the plurality of application icons are displayed in a predefined region of the display unit prior to detecting the gesture; and

the plurality of user interface objects are displayed in the predefined region of the display unit.

27. The electronic device of claim 26, wherein the plurality of user interface objects are displayed in front of and at least partially overlapping one or more of the plurality of application icons in the predefined region of the display unit.

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28. The electronic device of any of claims 21-27, wherein, enabling display of the plurality of user interface objects corresponding to the respective application includes:

enabling display of an animation of the plurality of application icons shifting backward into the display unit; and

enabling display of the plurality of user interface objects corresponding to the respective application in a location on the display unit previously occupied by the plurality of application icons.

29. The electronic device of any of claims 21-28, wherein enabling display of the plurality of user interface objects corresponding to the respective application includes, for a respective user interface object associated with the respective application:

initially enabling display of the respective user interface object at a location proximate to the respective application icon; and

after initially enabling display of the respective user interface object, enabling display of an animation of the respective user interface object moving from the location proximate to the respective application icon to a location proximate to another user interface object in the plurality of user interface objects.

30. The electronic device of any of claims 21-29, wherein the application window is a new application window that was not displayed on the display unit prior to detecting the contact.

31. A method, comprising:

at an electronic device with a touch-sensitive surface and a display, wherein the device includes one or more sensors to detect intensity of contacts with the touch-sensitive surface:

displaying a plurality of document icons, including a respective document icon corresponding to a respective electronic document associated with a respective application;

while a focus selector is over the respective document icon, detecting a gesture that includes a contact on the touch-sensitive surface; and

in response to detecting the gesture:

in accordance with a determination that the contact had a maximum intensity during the gesture that was below a respective intensity threshold, displaying the electronic document in a new application window of the respective application; and

in accordance with a determination that the contact reached an intensity during the gesture that was above the respective intensity threshold, displaying a preview of the

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respective electronic document without displaying a new application window of the respective application.

32. The method of claim 31, wherein displaying the preview of the respective electronic document includes displaying an animation of the respective document icon transforming into the preview of the respective electronic document, and a progression of the animation is determined in accordance with intensity of the contact on the touch-sensitive surface.

33. The method of any of claims 31-32, wherein the respective electronic document is displayed in the new window of the respective application after detecting liftoff of the contact on the touch-sensitive surface.

34. The method of any of claims 31-33, wherein the preview of the electronic document is displayed prior to detecting liftoff of the contact from the touch-sensitive surface.

35. The method of any of claims 31-34, wherein:

the device includes a preview application for previewing documents associated with a plurality of different applications;

the preview application is distinct from the respective application; and

the preview of the electronic document is displayed in the preview application.

36. The method of claim 35, wherein:

the respective application includes a plurality of document editing capabilities for editing the respective electronic document; and

the preview application does not include a respective document editing capability of the plurality of document editing capabilities.

37. The method of any of claims 31-36, further comprising, after detecting the gesture, detecting a subsequent gesture that corresponds to moving focus away from a representation of the electronic document; and

in response to detecting the subsequent gesture:

in accordance with a determination that the representation of the electronic document is the new application window in which the electronic document was opened, maintaining the electronic document in the new application window; and

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in accordance with a determination that the representation of the electronic document is a preview of the electronic document, ceasing to display the preview of the electronic document.

38. The method of any of claims 31-37, including:

while detecting the contact on the touch-sensitive surface, determining that the contact has exceeded the respective intensity threshold; and

in response to determining that the contact has exceeded the respective intensity threshold, changing an appearance of the document icon to indicate that a preview of the respective electronic document will be displayed in response to detecting an end of the gesture.

39. The method of claim 38, wherein changing an appearance of the document icon includes displaying an animation of the document icon growing smaller, wherein a progression of the animation is determined in accordance with an intensity of the contact.

40. An electronic device, comprising:

a display;

a touch-sensitive surface;

one or more sensors to detect intensity of contacts with the touch-sensitive surface;

one or more processors;

memory; and

one or more programs, wherein the one or more programs are stored in the memory and configured to be executed by the one or more processors, the one or more programs including instructions for:

displaying a plurality of document icons, including a respective document icon corresponding to a respective electronic document associated with a respective application;

while a focus selector is over the respective document icon, detecting a gesture that includes a contact on the touch-sensitive surface; and

in response to detecting the gesture:

in accordance with a determination that the contact had a maximum intensity during the gesture that was below a respective intensity threshold, displaying the electronic document in a new application window of the respective application; and

in accordance with a determination that the contact reached an intensity during the gesture that was above the respective intensity threshold, displaying a preview of the

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respective electronic document without displaying a new application window of the respective application.

41. A computer readable storage medium storing one or more programs, the one or more programs comprising instructions, which when executed by an electronic device with a display, a touch-sensitive surface, and one or more sensors to detect intensity of contacts with the touch-sensitive surface, cause the device to:

display a plurality of document icons, including a respective document icon corresponding to a respective electronic document associated with a respective application;

while a focus selector is over the respective document icon, detect a gesture that includes a contact on the touch-sensitive surface; and

in response to detecting the gesture:

in accordance with a determination that the contact had a maximum intensity during the gesture that was below a respective intensity threshold, display the electronic document in a new application window of the respective application; and

in accordance with a determination that the contact reached an intensity during the gesture that was above the respective intensity threshold, display a preview of the respective electronic document without displaying a new application window of the respective application.

42. A graphical user interface on an electronic device with a display, a touch-sensitive surface, and one or more sensors to detect intensity of contacts with the touch-sensitive surface, a memory, and one or more processors to execute one or more programs stored in the memory, the graphical user interface comprising:

a plurality of document icons, including a respective document icon corresponding to a respective electronic document associated with a respective application;

wherein:

in response to detecting a gesture that includes a contact on the touch-sensitive surface while a focus selector is over the respective document icon:

in accordance with a determination that the contact had a maximum intensity during the gesture that was below a respective intensity threshold, the electronic document is displayed in a new application window of the respective application; and

in accordance with a determination that the contact reached an intensity during the gesture that was above the respective intensity threshold, a preview of the respective

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electronic document is displayed without displaying a new application window of the respective application.

43. An electronic device, comprising:

a display;

a touch-sensitive surface;

one or more sensors to detect intensity of contacts with the touch-sensitive surface; and

means for displaying a plurality of document icons, including a respective document icon corresponding to a respective electronic document associated with a respective application;

means for, while a focus selector is over the respective document icon, detecting a gesture that includes a contact on the touch-sensitive surface; and

means responsive to detecting the gesture, including:

means for, in accordance with a determination that the contact had a maximum intensity during the gesture that was below a respective intensity threshold, displaying the electronic document in a new application window of the respective application; and

means for, in accordance with a determination that the contact reached an intensity during the gesture that was above the respective intensity threshold, displaying a preview of the respective electronic document without displaying a new application window of the respective application.

44. An information processing apparatus for use in an electronic device with a display, a touch-sensitive surface, and one or more sensors to detect intensity of contacts with the touch-sensitive surface, comprising:

means for displaying a plurality of document icons, including a respective document icon corresponding to a respective electronic document associated with a respective application;

means for, while a focus selector is over the respective document icon, detecting a gesture that includes a contact on the touch-sensitive surface; and

means responsive to detecting the gesture, including:

means for, in accordance with a determination that the contact had a maximum intensity during the gesture that was below a respective intensity threshold, displaying the electronic document in a new application window of the respective application; and

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means for, in accordance with a determination that the contact reached an intensity during the gesture that was above the respective intensity threshold, displaying a preview of the respective electronic document without displaying a new application window of the respective application.

45. An electronic device, comprising:
a display;
a touch-sensitive surface;
one or more sensors to detect intensity of contacts with the touch-sensitive surface;
one or more processors;
memory; and
one or more programs, wherein the one or more programs are stored in the memory and configured to be executed by the one or more processors, the one or more programs including instructions for performing any of the methods of claims 31-39.

46. A computer readable storage medium storing one or more programs, the one or more programs comprising instructions, which when executed by an electronic device with a display, a touch-sensitive surface, and one or more sensors to detect intensity of contacts with the touch-sensitive surface, cause the device to perform any of the methods of claims 31-39.

47. A graphical user interface on an electronic device with a display, a touch-sensitive surface, one or more sensors to detect intensity of contacts with the touch-sensitive surface, a memory, and one or more processors to execute one or more programs stored in the memory, the graphical user interface comprising user interfaces displayed in accordance with any of the methods of claims 31-39.

48. An electronic device, comprising:
a display;
a touch-sensitive surface;
one or more sensors to detect intensity of contacts with the touch-sensitive surface; and
means for performing any of the methods of claims 31-39.

49. An information processing apparatus for use in an electronic device with a display, a touch-sensitive surface, and one or more sensors to detect intensity of contacts with the touch-sensitive surface, comprising:

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means for performing any of the methods of claims 31-39.

50. An electronic device, comprising:

a display unit configured to display a plurality of document icons, including a respective document icon corresponding to a respective electronic document associated with a respective application;

a touch-sensitive surface unit configured to receive gestures that include contacts;

one or more sensor units configured to detect intensity of contacts with the touch-sensitive surface unit; and

a processing unit coupled to the display unit, the touch-sensitive surface unit, and the sensor units, the processing unit configured to:

while a focus selector is over the respective document icon, detect a gesture that includes a contact on the touch-sensitive surface unit; and

in response to detecting the gesture:

in accordance with a determination that the contact had a maximum intensity during the gesture that was below a respective intensity threshold, enable display of the electronic document in a new application window of the respective application; and

in accordance with a determination that the contact reached an intensity during the gesture that was above the respective intensity threshold, enable display of a preview of the respective electronic document without enabling display of a new application window of the respective application.

51. The electronic device of claim 50, wherein enabling display of the preview of the respective electronic document includes enabling display of an animation of the respective document icon transforming into the preview of the respective electronic document, and a progression of the animation is determined in accordance with intensity of the contact on the touch-sensitive surface unit.

52. The electronic device of any of claims 50-51, wherein the respective electronic document is displayed in the new window of the respective application after detecting liftoff of the contact on the touch-sensitive surface unit.

53. The electronic device of any of claims 50-52, wherein the preview of the electronic document is displayed prior to detecting liftoff of the contact from the touch-sensitive surface unit.

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54. The electronic device of any of claims 50-53, wherein:

the device includes a preview application for previewing documents associated with a plurality of different applications;

the preview application is distinct from the respective application; and

the preview of the electronic document is displayed in the preview application.

55. The electronic device of claim 54, wherein:

the respective application includes a plurality of document editing capabilities for editing the respective electronic document; and

the preview application does not include a respective document editing capability of the plurality of document editing capabilities.

56. The electronic device of any of claims 50-55, wherein the processing unit is configured to:

after detecting the gesture, detect a subsequent gesture that corresponds to moving focus away from a representation of the electronic document; and

in response to detecting the subsequent gesture:

in accordance with a determination that the representation of the electronic document is the new application window in which the electronic document was opened, maintain the electronic document in the new application window; and

in accordance with a determination that the representation of the electronic document is a preview of the electronic document, cease to display the preview of the electronic document.

57. The electronic device of any of claims 50-56, wherein the processing unit is configured to:

while detecting the contact on the touch-sensitive surface unit, determine that the contact has exceeded the respective intensity threshold; and

in response to determining that the contact has exceeded the respective intensity threshold, change an appearance of the document icon to indicate that a preview of the respective electronic document will be displayed in response to detecting an end of the gesture.

58. The electronic device of claim 57, wherein changing an appearance of the document icon includes enabling display of an animation of the document icon growing smaller,

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wherein a progression of the animation is determined in accordance with an intensity of the contact.

59. A method, comprising:

at an electronic device with a touch-sensitive surface and a display, wherein the device includes one or more sensors to detect intensity of contacts with the touch-sensitive surface:

displaying a frame for previewing content, wherein the frame corresponds to a plurality of content items;

detecting movement of a contact across the touch-sensitive surface;

moving a focus selector across the frame in accordance with the movement of the contact across the touch-sensitive surface;

sequentially displaying, in the frame, previews of respective content items in the plurality of content items in accordance with the movement of the focus selector across the frame, wherein a size of the previews is constrained to a size of the frame;

while a respective preview of a respective content item is displayed in the frame at a first size, detecting an increase in intensity of the contact;

in response to detecting the increase in intensity of the contact, increasing the size of the respective preview to a second size larger than the size of the frame;

while displaying the respective preview at the second size, detecting a decrease in intensity of the contact; and

in response to detecting the decrease in intensity of the contact, reducing the size of the respective preview to the first size.

60. The method of claim 59, wherein the contact is a single unbroken contact from a point in time when the movement of the contact across the touch-sensitive surface is detected to a point in time when the decrease in intensity of the contact is detected.

61. The method of any of claims 59-60, wherein detecting the decrease in intensity of the contact includes detecting liftoff of the contact.

62. The method of any of claims 59-60, wherein detecting the decrease in intensity of the contact includes detecting a decrease in intensity of the contact while continuing to detect the contact on the touch-sensitive surface.

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63. The method of any of claims 59-62, including displaying a plurality of frames for previewing content, wherein each frame of the plurality of frames corresponds to a different plurality of content items.

64. The method of any of claims 59-63, wherein increasing the size of the respective preview includes displaying an animation of the respective preview increasing in size in accordance with the intensity of the contact.

65. The method of any of claims 59-64, wherein reducing the size of the respective preview includes displaying an animation of the respective preview decreasing in size in accordance with the intensity of the contact.

66. The method of any of claims 59-65, including:

detecting additional movement of the contact corresponding to lateral movement of the focus selector on the display; and

in response to detecting the additional movement of the contact:

in accordance with detecting the additional movement while displaying the respective preview at the first size, ceasing to display the respective preview and sequentially displaying, at the first size, previews of respective content items in the plurality of content items in accordance with the movement of the focus selector across the frame; and

in accordance with detecting the additional movement while displaying the respective preview at the second size, maintaining display of the respective preview on the display.

67. The method of any of claims 59-65, including:

detecting additional movement of the contact corresponding to lateral movement of the focus selector on the display; and

in response to detecting the additional movement of the contact:

in accordance with detecting the additional movement while displaying the respective preview at the first size, ceasing to display the respective preview and sequentially displaying, at the first size, previews of respective content items in the plurality of content items in accordance with the movement of the focus selector across the frame; and

in accordance with detecting the additional movement while displaying the respective preview at the second size, ceasing to display the respective preview and sequentially displaying, at the second size, previews of respective content items in the

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plurality of content items in accordance with the movement of the focus selector across a region of the display corresponding to the frame.

68. An electronic device, comprising:

a display;

a touch-sensitive surface;

one or more sensors to detect intensity of contacts with the touch-sensitive surface;

one or more processors;

memory; and

one or more programs, wherein the one or more programs are stored in the memory and configured to be executed by the one or more processors, the one or more programs including instructions for:

displaying a frame for previewing content, wherein the frame corresponds to a plurality of content items;

detecting movement of a contact across the touch-sensitive surface;

moving a focus selector across the frame in accordance with the movement of the contact across the touch-sensitive surface;

sequentially displaying, in the frame, previews of respective content items in the plurality of content items in accordance with the movement of the focus selector across the frame, wherein a size of the previews is constrained to a size of the frame;

while a respective preview of a respective content item is displayed in the frame at a first size, detecting an increase in intensity of the contact;

in response to detecting the increase in intensity of the contact, increasing the size of the respective preview to a second size larger than the size of the frame;

while displaying the respective preview at the second size, detecting a decrease in intensity of the contact; and

in response to detecting the decrease in intensity of the contact, reducing the size of the respective preview to the first size.

69. A computer readable storage medium storing one or more programs, the one or more programs comprising instructions, which when executed by an electronic device with a display, a touch-sensitive surface and one or more sensors to detect intensity of contacts with the touch-sensitive surface, cause the device to:

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display a frame for previewing content, wherein the frame corresponds to a plurality of content items;

detect movement of a contact across the touch-sensitive surface;

move a focus selector across the frame in accordance with the movement of the contact across the touch-sensitive surface;

sequentially display, in the frame, previews of respective content items in the plurality of content items in accordance with the movement of the focus selector across the frame, wherein a size of the previews is constrained to a size of the frame;

while a respective preview of a respective content item is displayed in the frame at a first size, detect an increase in intensity of the contact;

in response to detecting the increase in intensity of the contact, increase the size of the respective preview to a second size larger than the size of the frame;

while displaying the respective preview at the second size, detect a decrease in intensity of the contact; and

in response to detecting the decrease in intensity of the contact, reduce the size of the respective preview to the first size.

70. A graphical user interface on an electronic device with a display, a touch-sensitive surface, and one or more sensors to detect intensity of contacts with the touch-sensitive surface, a memory, and one or more processors to execute one or more programs stored in the memory, the graphical user interface comprising:

a frame for previewing content, wherein the frame corresponds to a plurality of content items;

wherein:

in response to detection of movement of a contact across the touch-sensitive surface, a focus selector is moved across the frame in accordance with the movement of the contact across the touch-sensitive surface;

previews of respective content items in the plurality of content items are sequentially displayed in the frame in accordance with the movement of the focus selector across the frame, wherein a size of the previews is constrained to a size of the frame;

in response to detection of an increase in intensity of the contact while a respective preview of a respective content item is displayed in the frame at a first size, the size of the respective preview is increased to a second size larger than the size of the frame; and

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in response to detection of a decrease in intensity of the contact while displaying the respective preview at the second size, the size of the respective preview is reduced to the first size.

71. An electronic device, comprising:

a display;

a touch-sensitive surface;

one or more sensors to detect intensity of contacts with the touch-sensitive surface;

means for displaying a frame for previewing content, wherein the frame corresponds to a plurality of content items;

means for detecting movement of a contact across the touch-sensitive surface;

means for moving a focus selector across the frame in accordance with the movement of the contact across the touch-sensitive surface;

means for sequentially displaying, in the frame, previews of respective content items in the plurality of content items in accordance with the movement of the focus selector across the frame, wherein a size of the previews is constrained to a size of the frame;

means for, while a respective preview of a respective content item is displayed in the frame at a first size, detecting an increase in intensity of the contact;

means, responsive to detecting the increase in intensity of the contact, for increasing the size of the respective preview to a second size larger than the size of the frame;

means for, while displaying the respective preview at the second size, detecting a decrease in intensity of the contact; and

means, responsive to detecting the decrease in intensity of the contact, for reducing the size of the respective preview to the first size.

72. An information processing apparatus for use in an electronic device with a display, a touch-sensitive surface, and one or more sensors to detect intensity of contacts with the touch-sensitive surface, comprising:

means for displaying a frame for previewing content, wherein the frame corresponds to a plurality of content items;

means for detecting movement of a contact across the touch-sensitive surface;

means for moving a focus selector across the frame in accordance with the movement of the contact across the touch-sensitive surface;

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means for sequentially displaying, in the frame, previews of respective content items in the plurality of content items in accordance with the movement of the focus selector across the frame, wherein a size of the previews is constrained to a size of the frame;

means for, while a respective preview of a respective content item is displayed in the frame at a first size, detecting an increase in intensity of the contact;

means, responsive to detecting the increase in intensity of the contact, for increasing the size of the respective preview to a second size larger than the size of the frame;

means for, while displaying the respective preview at the second size, detecting a decrease in intensity of the contact; and

means, responsive to detecting the decrease in intensity of the contact, for reducing the size of the respective preview to the first size.

73. An electronic device, comprising:

a display;

a touch-sensitive surface;

one or more sensors to detect intensity of contacts with the touch-sensitive surface;

one or more processors;

memory; and

one or more programs, wherein the one or more programs are stored in the memory and configured to be executed by the one or more processors, the one or more programs including instructions for performing any of the methods of claims 59-67.

74. A computer readable storage medium storing one or more programs, the one or more programs comprising instructions, which when executed by an electronic device with a display, a touch-sensitive surface, and one or more sensors to detect intensity of contacts with the touch-sensitive surface, cause the device to perform any of the methods of claims 59-67.

75. A graphical user interface on an electronic device with a display, a touch-sensitive surface, one or more sensors to detect intensity of contacts with the touch-sensitive surface, a memory, and one or more processors to execute one or more programs stored in the memory, the graphical user interface comprising user interfaces displayed in accordance with any of the methods of claims 59-67.

76. An electronic device, comprising:

a display;

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a touch-sensitive surface;

one or more sensors to detect intensity of contacts with the touch-sensitive surface; and

means for performing any of the methods of claims 59-67.

77. An information processing apparatus for use in an electronic device with a display, a touch-sensitive surface, and one or more sensors to detect intensity of contacts with the touch-sensitive surface, comprising:

means for performing any of the methods of claims 59-67.

78. An electronic device, comprising:

a display unit configured to display a frame for previewing content, wherein the frame corresponds to a plurality of content items;

a touch-sensitive surface unit configured to receive contacts;

one or more sensor units configured to detect intensity of contacts with the touch-sensitive surface unit; and

a processing unit coupled to the display unit, the touch-sensitive surface unit, and the sensor units, the processing unit configured to:

detect movement of a contact across the touch-sensitive surface unit;

move a focus selector across the frame in accordance with the movement of the contact across the touch-sensitive surface unit;

enable sequential display of, in the frame, previews of respective content items in the plurality of content items in accordance with the movement of the focus selector across the frame, wherein a size of the previews is constrained to a size of the frame;

while a respective preview of a respective content item is displayed in the frame at a first size, detect an increase in intensity of the contact;

in response to detecting the increase in intensity of the contact, increase the size of the respective preview to a second size larger than the size of the frame;

while displaying the respective preview at the second size, detect a decrease in intensity of the contact; and

in response to detecting the decrease in intensity of the contact, reduce the size of the respective preview to the first size.

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79. The electronic device of claim 78, wherein the contact is a single unbroken contact from a point in time when the movement of the contact across the touch-sensitive surface unit is detected to a point in time when the decrease in intensity of the contact is detected.

80. The electronic device of any of claims 78-79, wherein detecting the decrease in intensity of the contact includes detecting liftoff of the contact.

81. The electronic device of any of claims 78-79, wherein detecting the decrease in intensity of the contact includes detecting a decrease in intensity of the contact while continuing to detect the contact on the touch-sensitive surface unit.

82. The electronic device of any of claims 78-81, wherein the processing unit is configured to: enable display of a plurality of frames for previewing content, wherein each frame of the plurality of frames corresponds to a different plurality of content items.

83. The electronic device of any of claims 78-80, wherein increasing the size of the respective preview includes displaying an animation of the respective preview increasing in size in accordance with the intensity of the contact.

84. The electronic device of any of claims 78-81, wherein reducing the size of the respective preview includes displaying an animation of the respective preview decreasing in size in accordance with the intensity of the contact.

85. The electronic device of any of claims 78-83, wherein the processing unit is configured to:

detect additional movement of the contact corresponding to lateral movement of the focus selector on the display unit; and

in response to detecting the additional movement of the contact:

in accordance with detecting the additional movement while displaying the respective preview at the first size, cease to display the respective preview and enable sequential display of, at the first size, previews of respective content items in the plurality of content items in accordance with the movement of the focus selector across the frame; and

in accordance with detecting the additional movement while displaying the respective preview at the second size, maintain display of the respective preview on the display.

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86. The electronic device of any of claims 78-83, wherein the processing unit is configured to:

detect additional movement of the contact corresponding to lateral movement of the focus selector on the display unit; and

in response to detecting the additional movement of the contact:

in accordance with detecting the additional movement while displaying the respective preview at the first size, cease to display the respective preview and enable sequential display of, at the first size, previews of respective content items in the plurality of content items in accordance with the movement of the focus selector across the frame; and

in accordance with detecting the additional movement while displaying the respective preview at the second size, cease to display the respective preview and enable sequential display of, at the second size, previews of respective content items in the plurality of content items in accordance with the movement of the focus selector across a region of the display unit corresponding to the frame.

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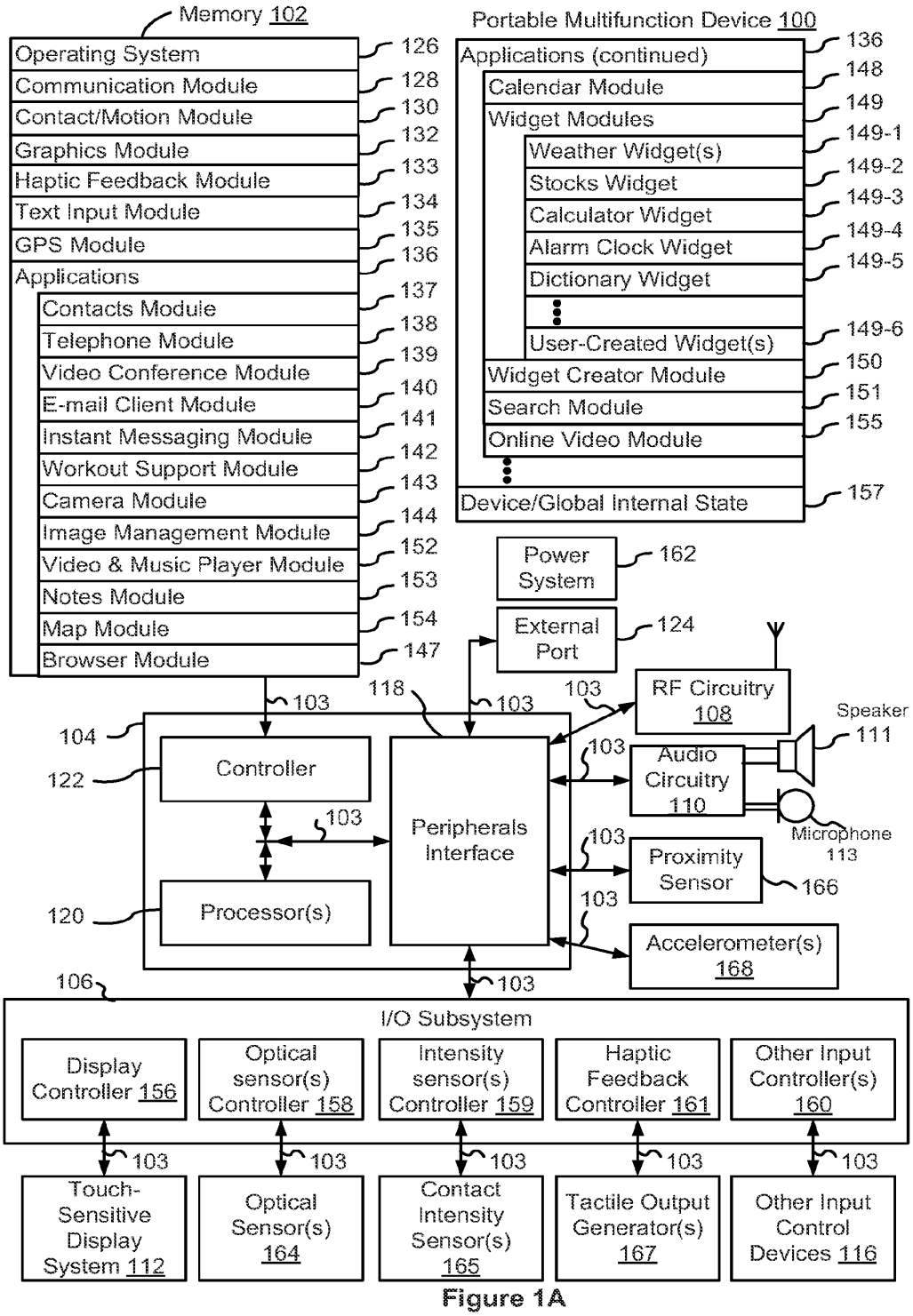

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Communication Module
128
Contact/Motion Module
130
Graphics Module
132
Haptic Feedback Module
133
Text Input Module
134
GPS Module
135
Applications
136
Contacts Module
137
Telephone Module
138
Video Conference Module
139
E-mail Client Module
140
Instant Messaging Module
141
Workout Support Module
142
Camera Module
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Image Management Module
144
Video & Music Player Module
152
Notes Module
153
Map Module
154
Browser Module
147
Portable Multifunction Device 100
Applications (continued)
136
Calendar Module
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Widget Modules
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Weather Widget(s)
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Stocks Widget
149-2
Calculator Widget
149-3
Alarm Clock Widget
149-4
Dictionary Widget
149-5
User-Created Widget(s)
149-6
Widget Creator Module
150
Search Module
151
Online Video Module
155
Device/Global Internal State
157
Power System
162
External Port
124
RF Circuitry 108
Speaker 111
Audio Circuitry 110
Microphone 113
Proximity Sensor
166
Accelerometer(s) 168
Peripherals Interface
Controller
Processor(s)
104
122
120
118
103
106
I/O Subsystem
Display Controller 156
Optical sensor(s) Controller 158
Intensity sensor(s) Controller 159
Haptic Feedback Controller 161
Other Input Controller(s) 160
Touch-Sensitive Display System 112
Optical Sensor(s) 164
Contact Intensity Sensor(s) 165
Tactile Output Generator(s) 167
Other Input Control Devices 116

Figure 1A

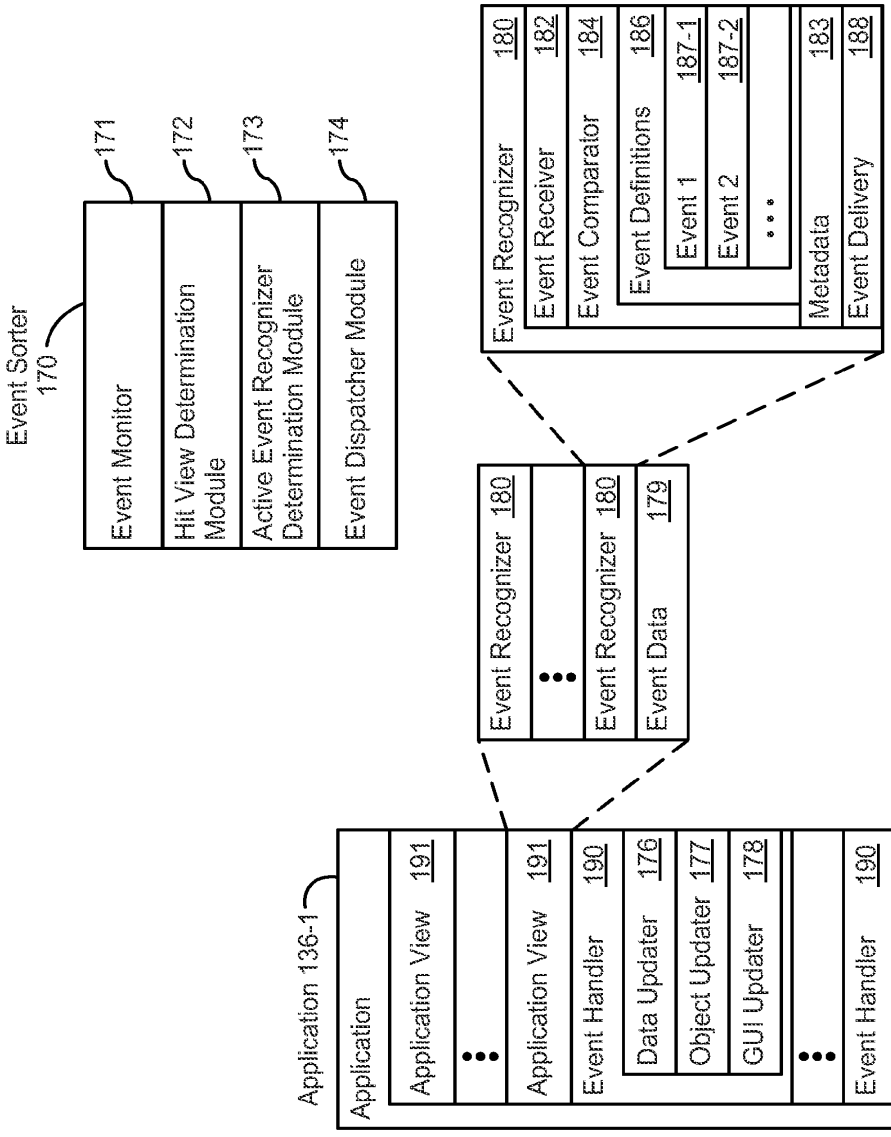

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Event Monitor
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Hit View Determination Module
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Active Event Recognizer Determination Module
173
Event Dispatcher Module
174
Application 136-1
Application
Application View 191
Application View 191
Event Handler 190
Data Updater 176
Object Updater 177
GUI Updater 178
Event Handler 190
Application Internal State 192
Event Recognizer 180
Event Recognizer 180
Event Data 179
Event Recognizer 180
Event Receiver 182
Event Comparator 184
Event Definitions 186
Event 1 187-1
Event 2 187-2
Metadata 183
Event Delivery 188

Figure 1B

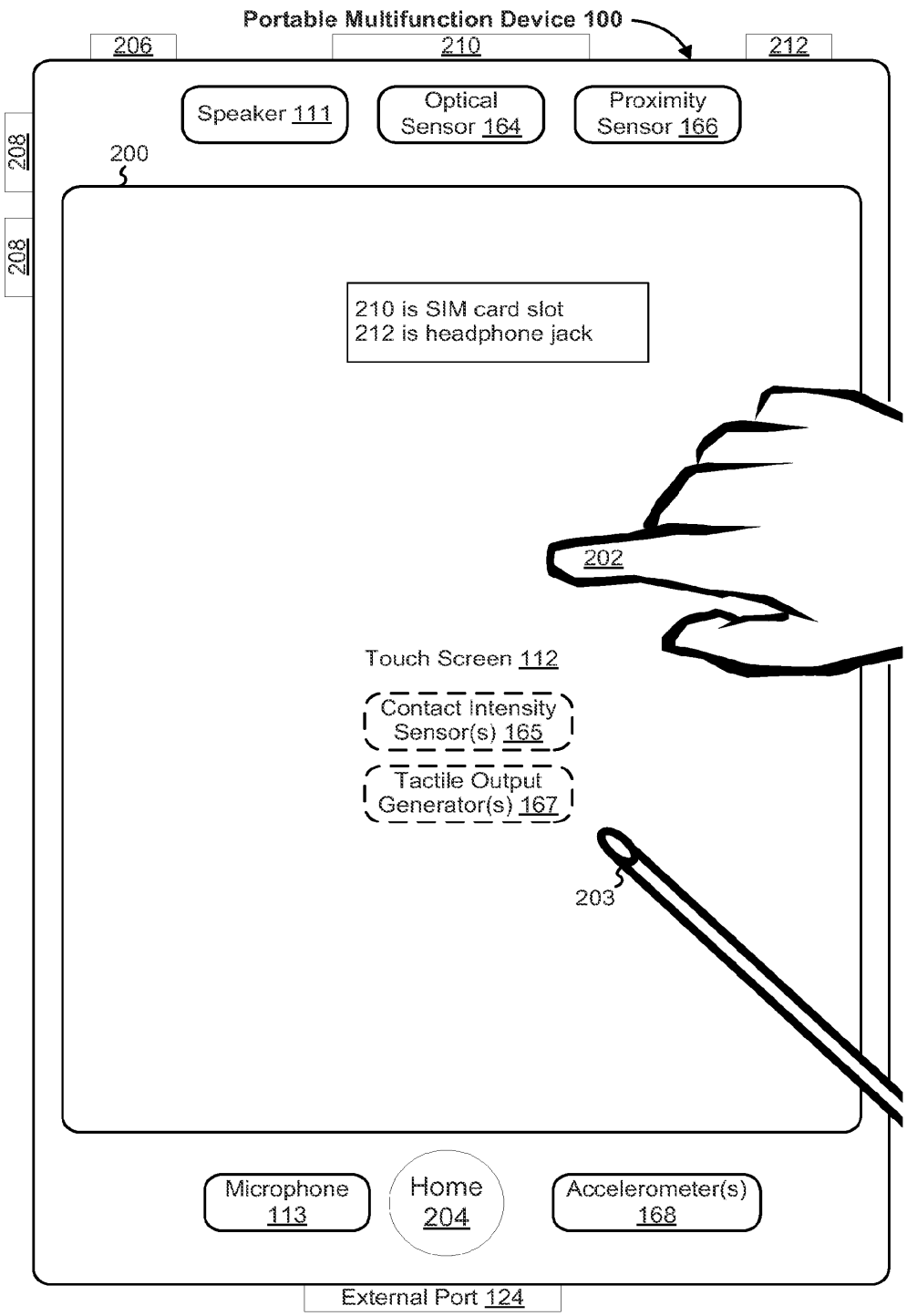

Portable Multifunction Device 100
206
210
212
Speaker 111
Optical Sensor 164
Proximity Sensor 166
208
208
200
210 is SIM card slot
212 is headphone jack
202
Touch Screen 112
Contact Intensity Sensor(s) 165
Tactile Output Generator(s) 167
203
Microphone 113
Home 204
Accelerometer(s) 168
External Port 124

Figure 2

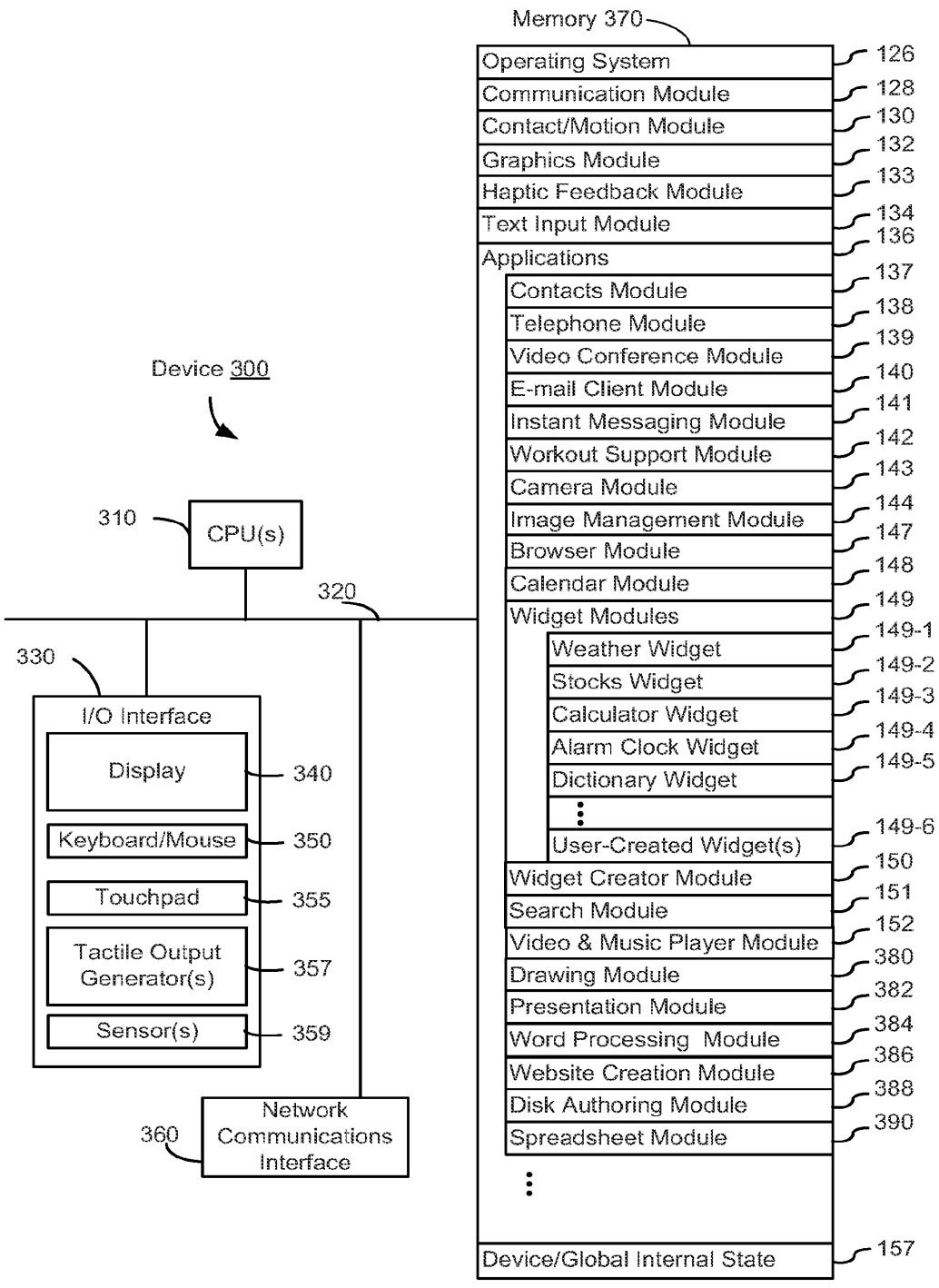

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Workout Support Module
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Image Management Module
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Weather Widget
149-1
Stocks Widget
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Calculator Widget
149-3
Alarm Clock Widget
149-4
Dictionary Widget
149-5
User-Created Widget(s)
149-6
Widget Creator Module
150
Search Module
151
Video & Music Player Module
152
Drawing Module
380
Presentation Module
382
Word Processing Module
384
Website Creation Module
386
Disk Authoring Module
388
Spreadsheet Module
390
Device/Global Internal State
157
Device 300
310
CPU(s)
320
330
I/O Interface
Display
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Keyboard/Mouse
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Touchpad
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Tactile Output Generator(s)
357
Sensor(s)
359
Network Communications Interface
360

Figure 3

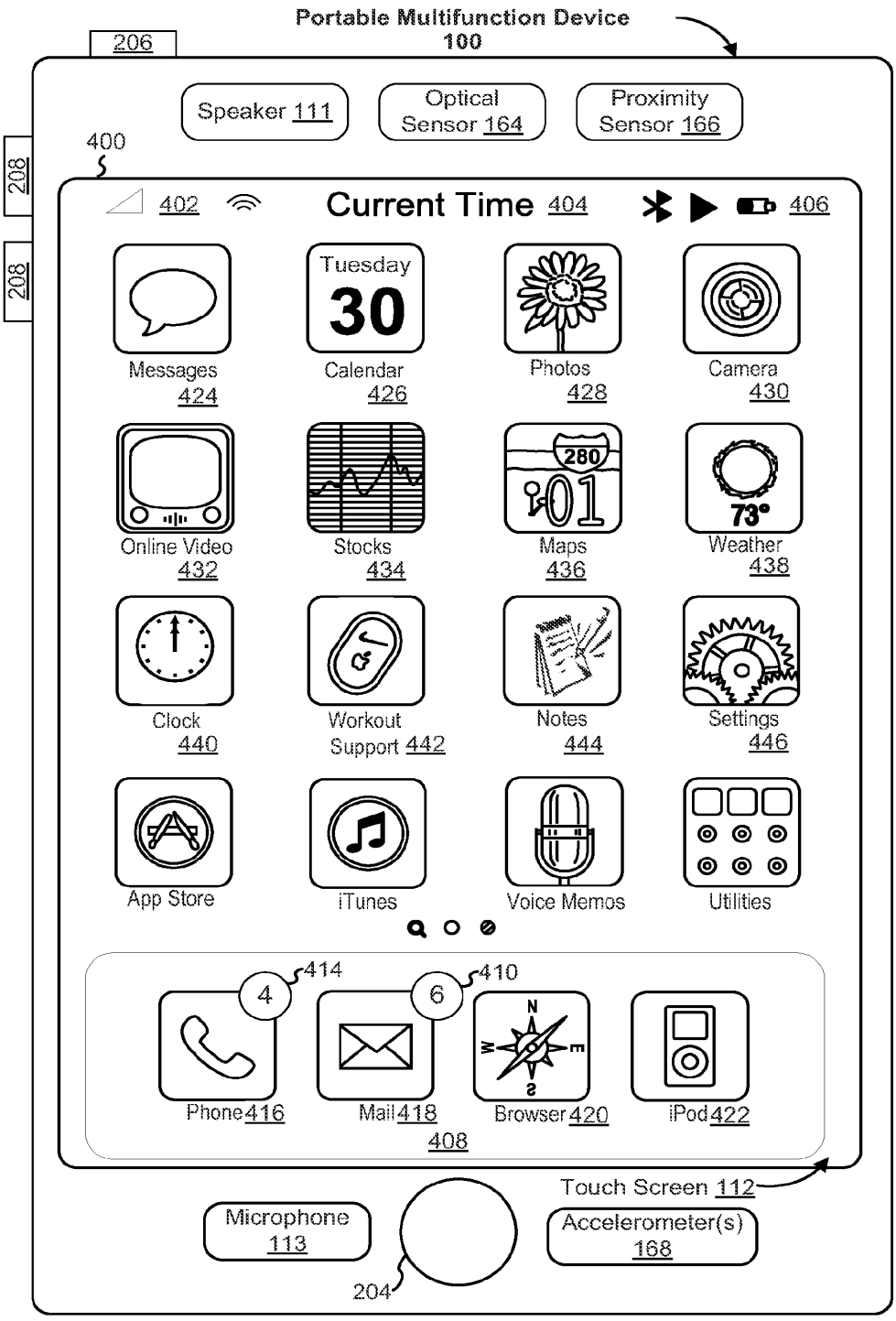
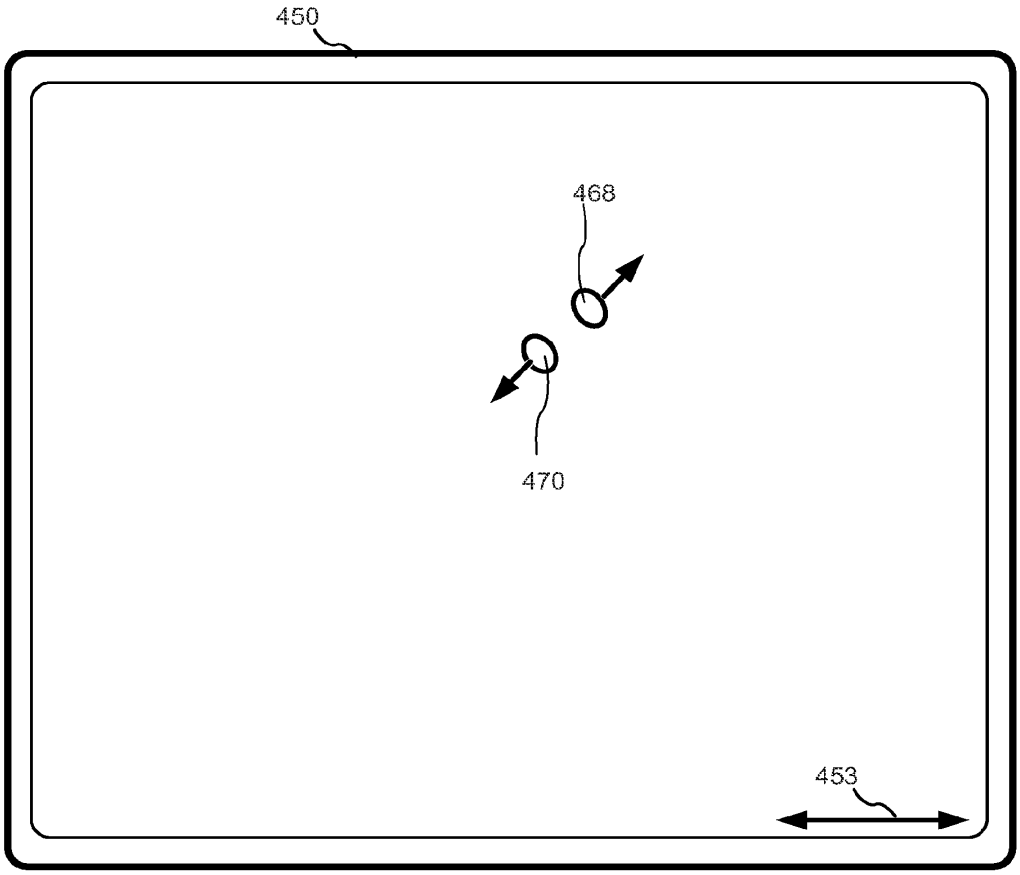

Portable Multifunction Device
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Speaker 111
Optical Sensor 164
Proximity Sensor 166
400
208
208
402
Current Time 404
406
Messages 424
Tuesday
30
Calendar 426
Photos 428
Camera 430
Online Video 432
Stocks 434
280
Maps 436
73°
Weather 438
Clock 440
Workout Support 442
Notes 444
Settings 446
App Store
iTunes
Voice Memos
Utilities
414
410
4
6
Phone 416
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Browser 420
iPod 422
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Touch Screen 112
Microphone 113
Accelerometer(s) 168
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Figure 4A


450
468
470
453

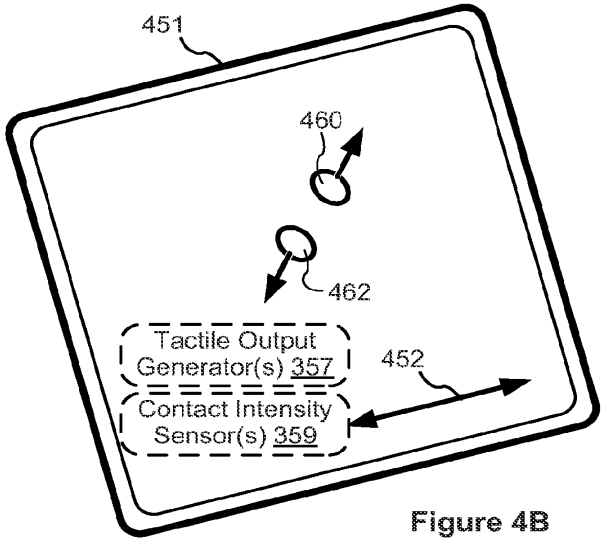

451
460
462
Tactile Output Generator(s) 357
452
Contact Intensity Sensor(s) 359

Figure 4B

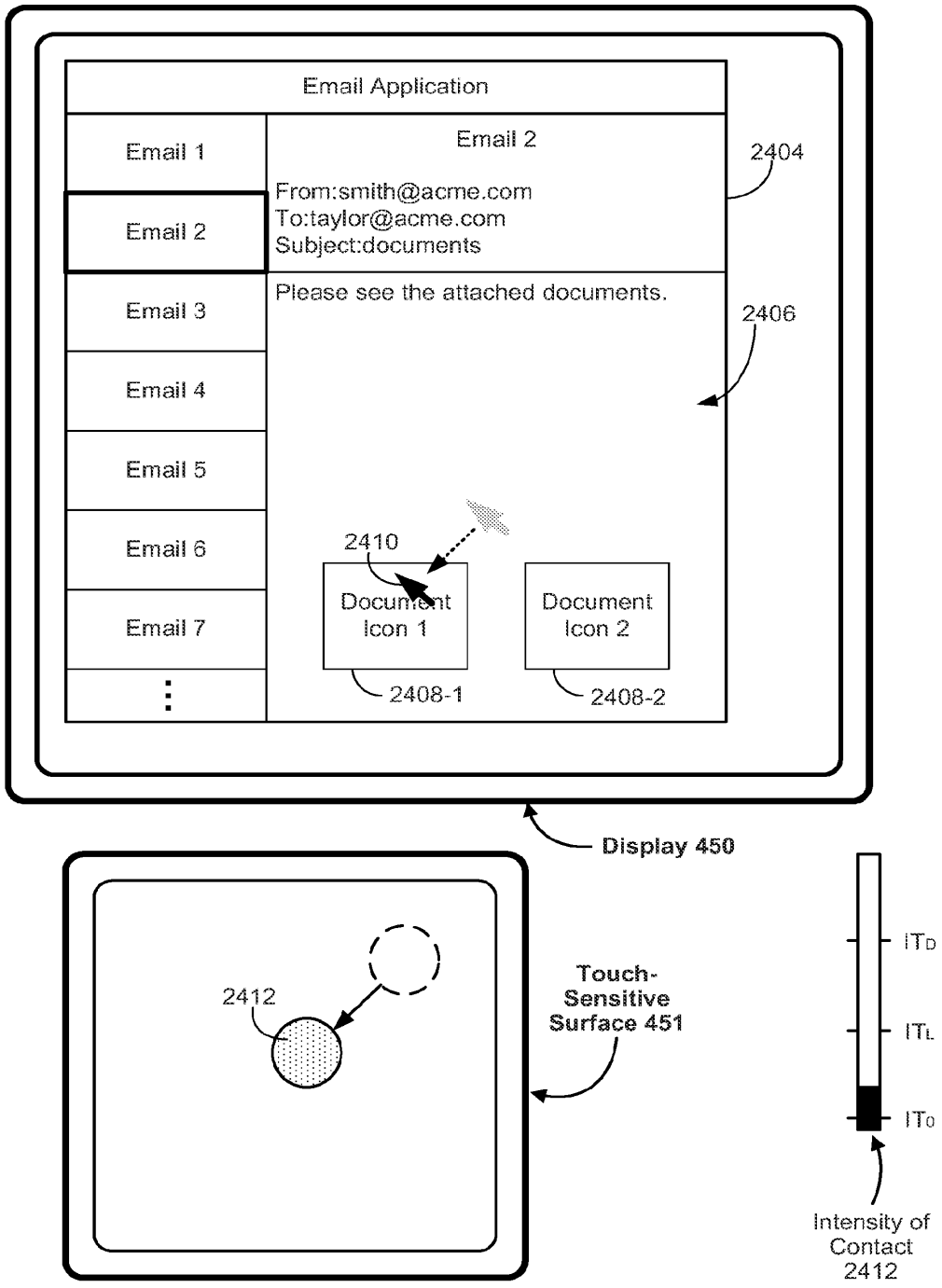

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Figure 5A

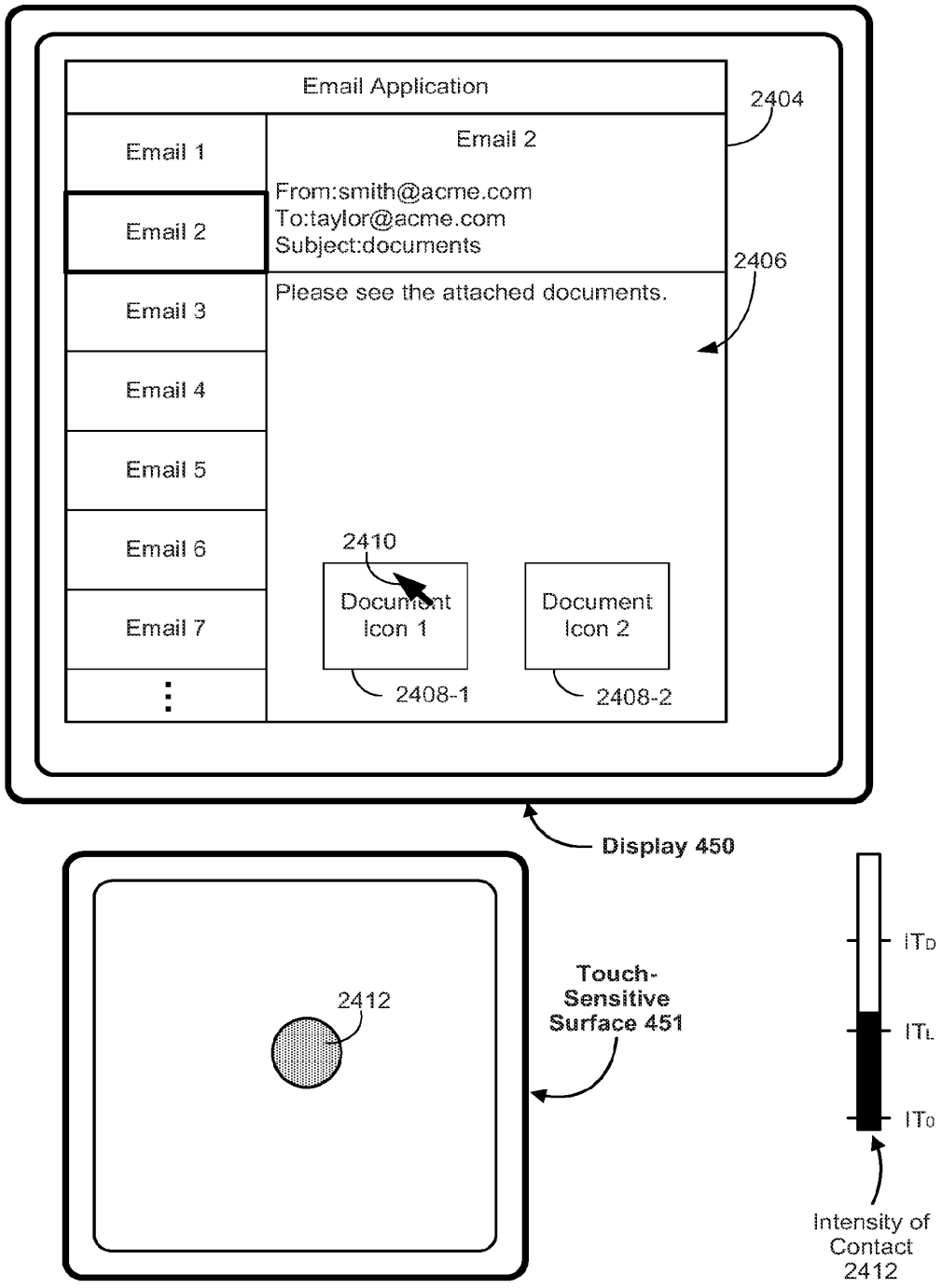

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Figure 5B

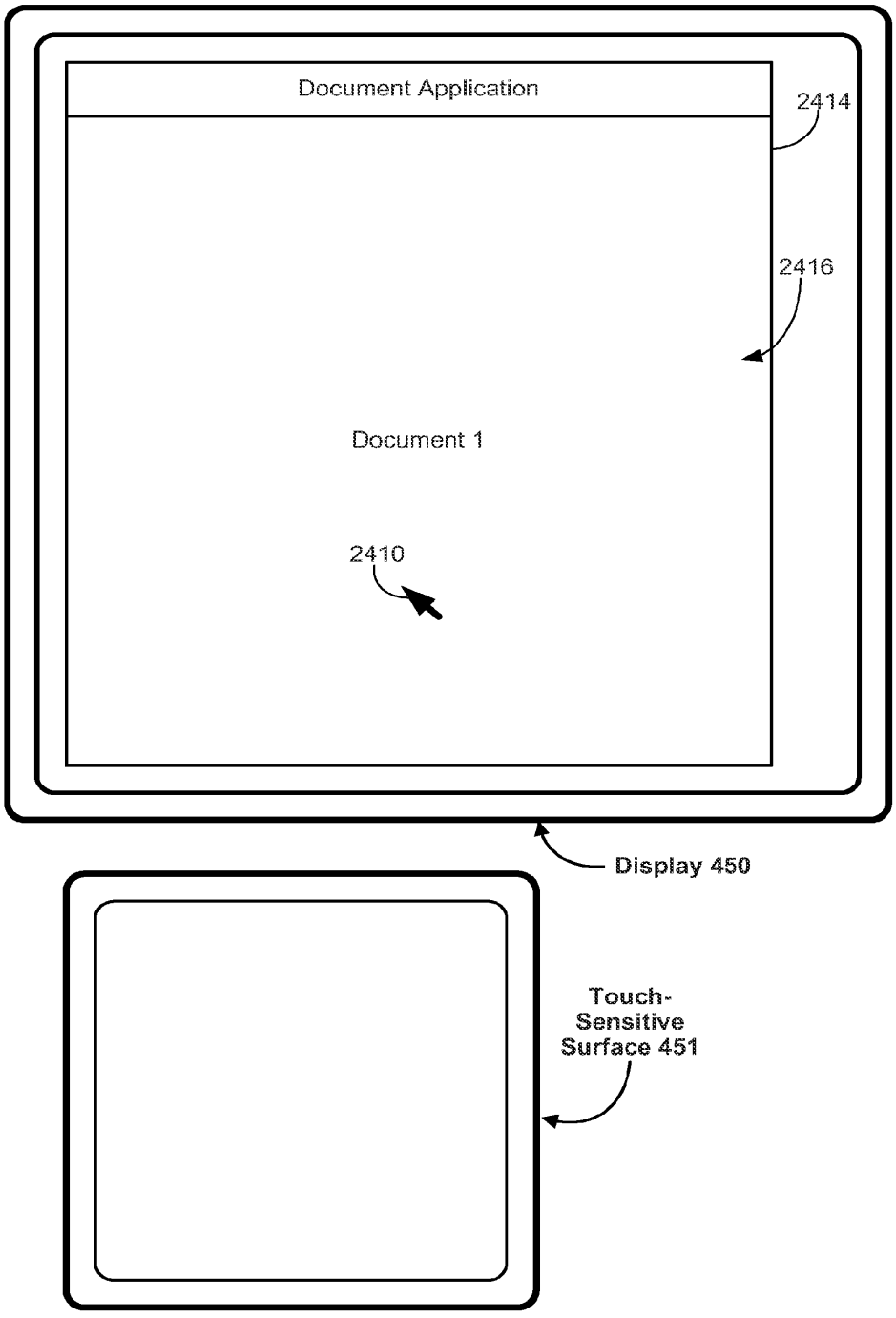

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Figure 5C

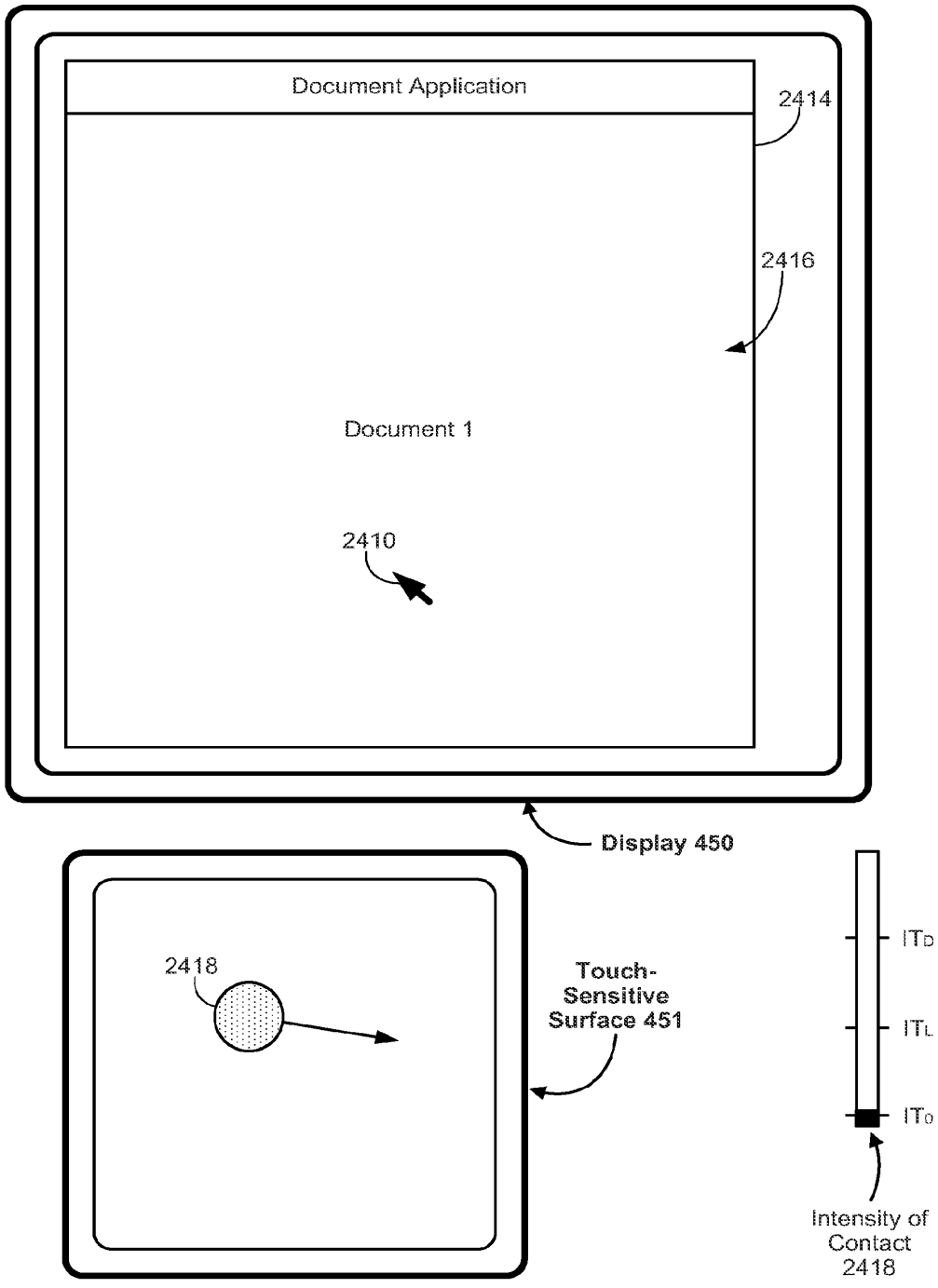

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Figure 5D

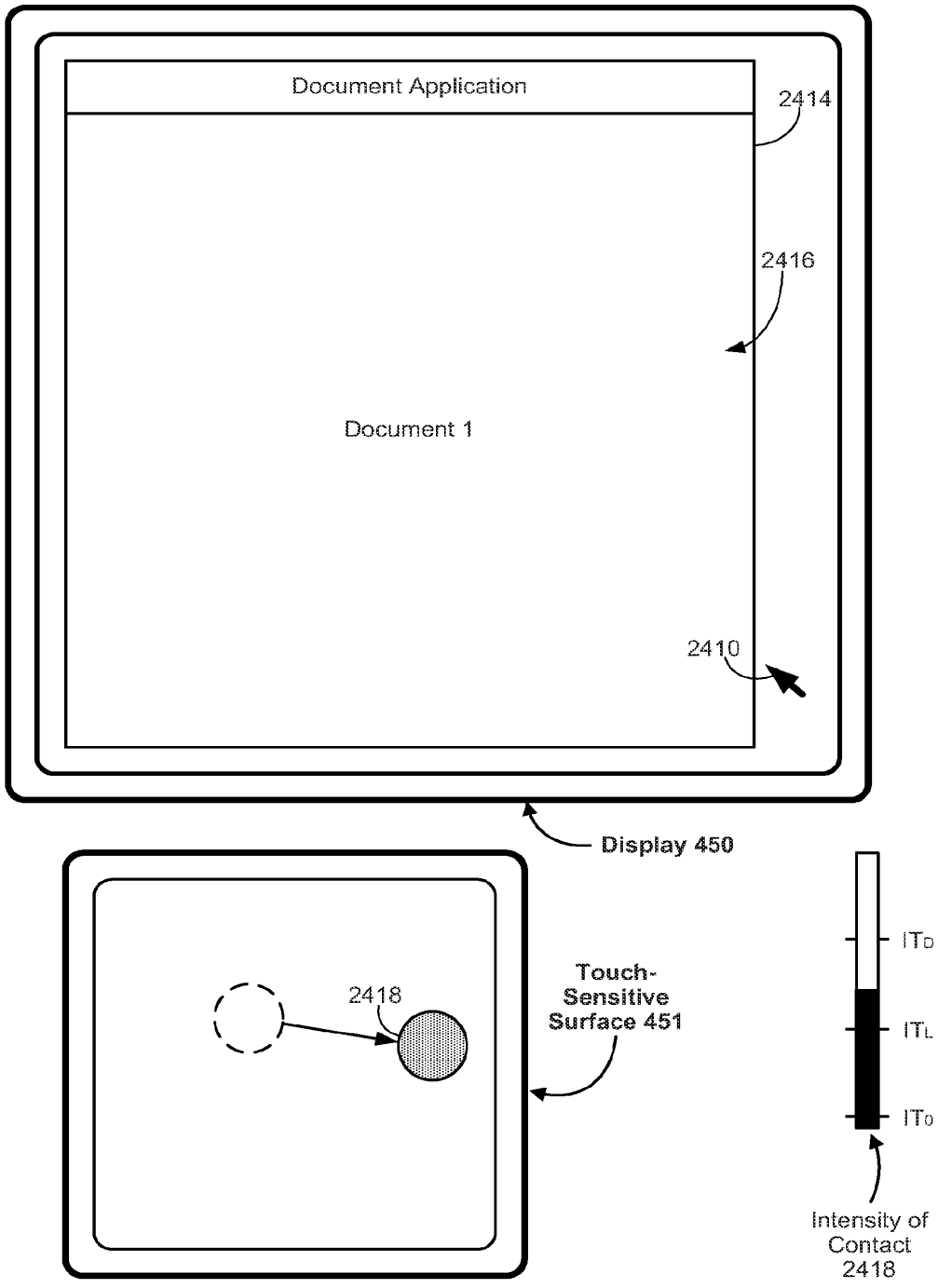

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Intensity of Contact 2418

Figure 5E

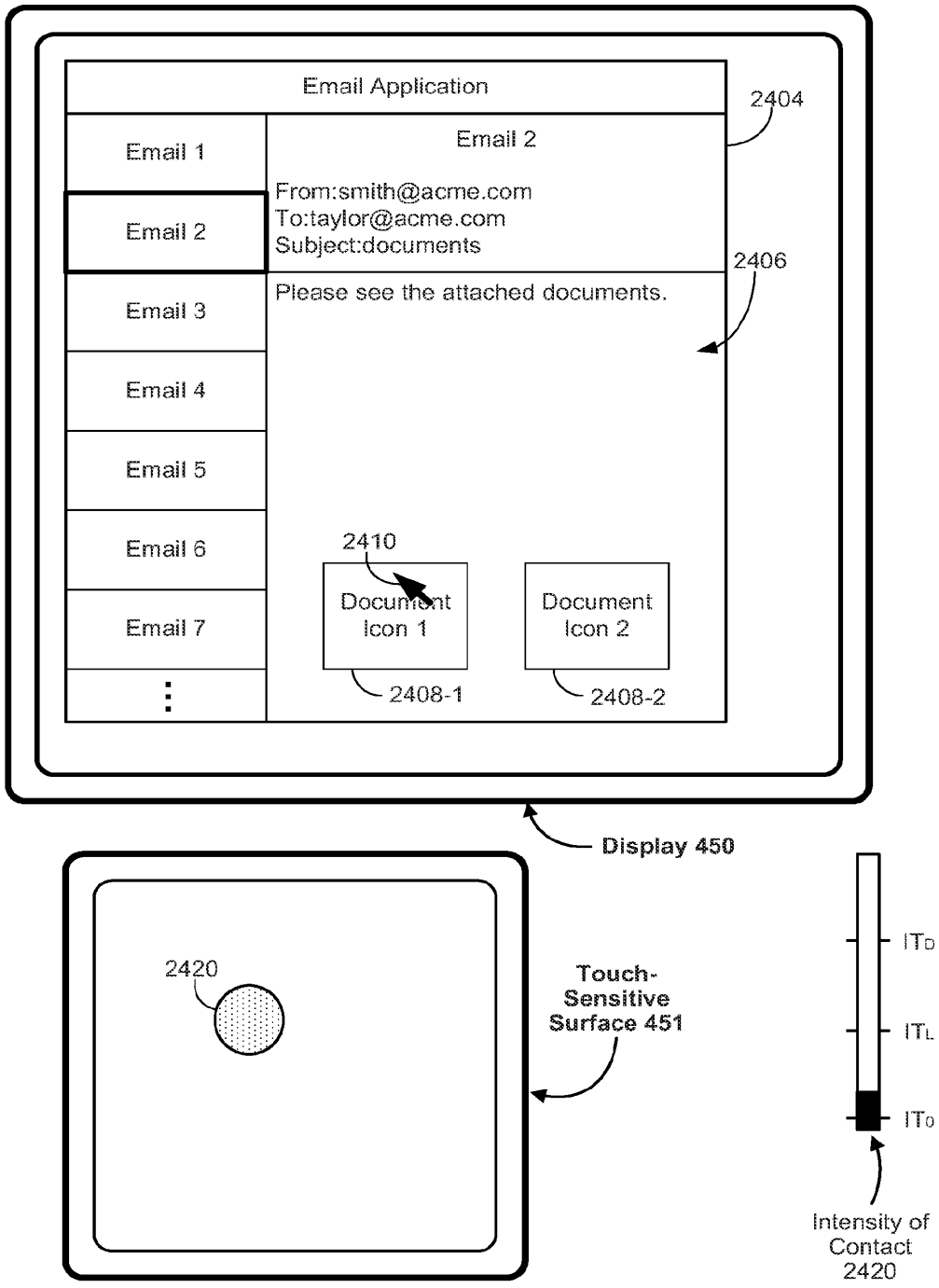

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Figure 5F

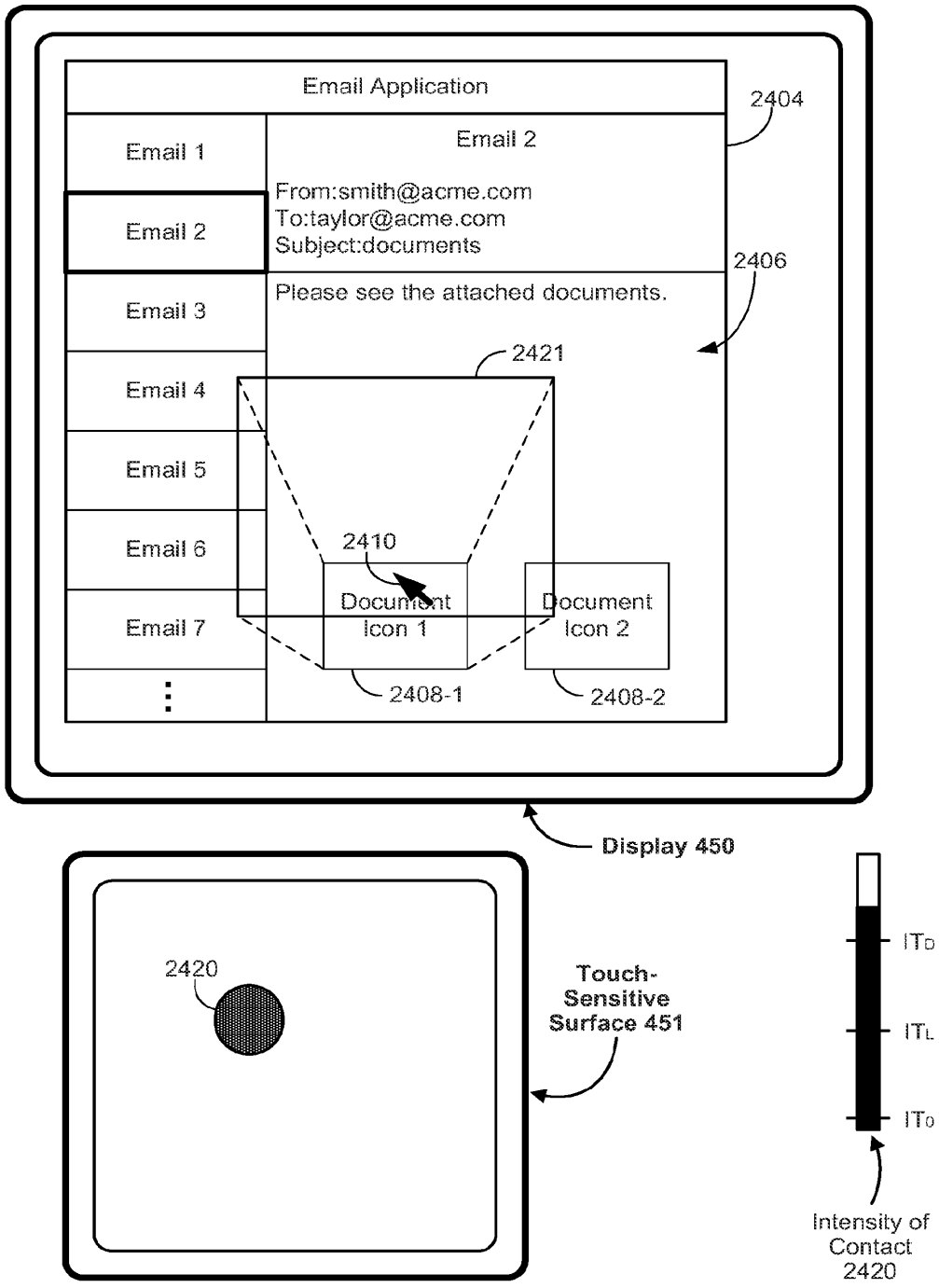

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Figure 5G

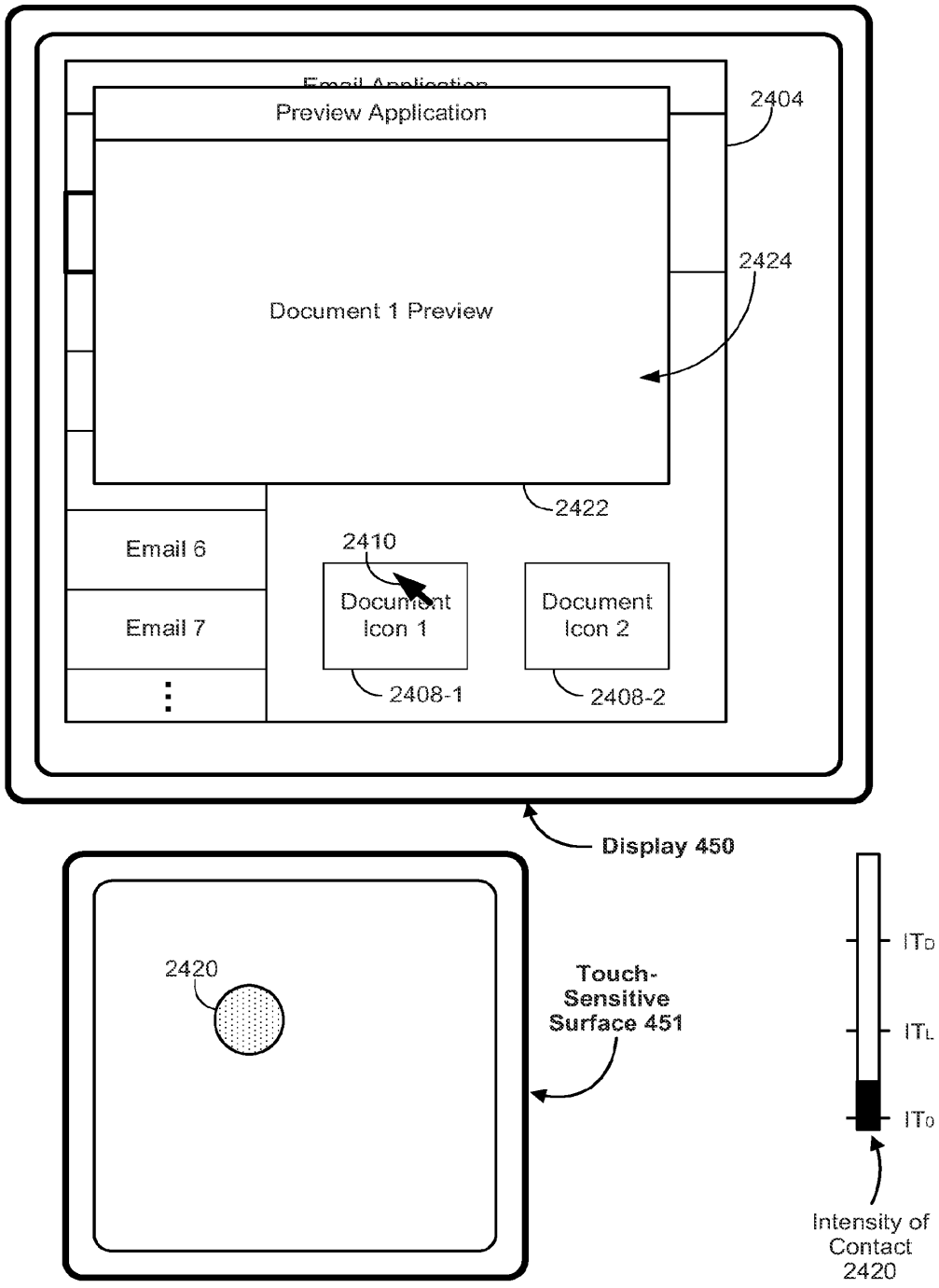

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Figure 5H

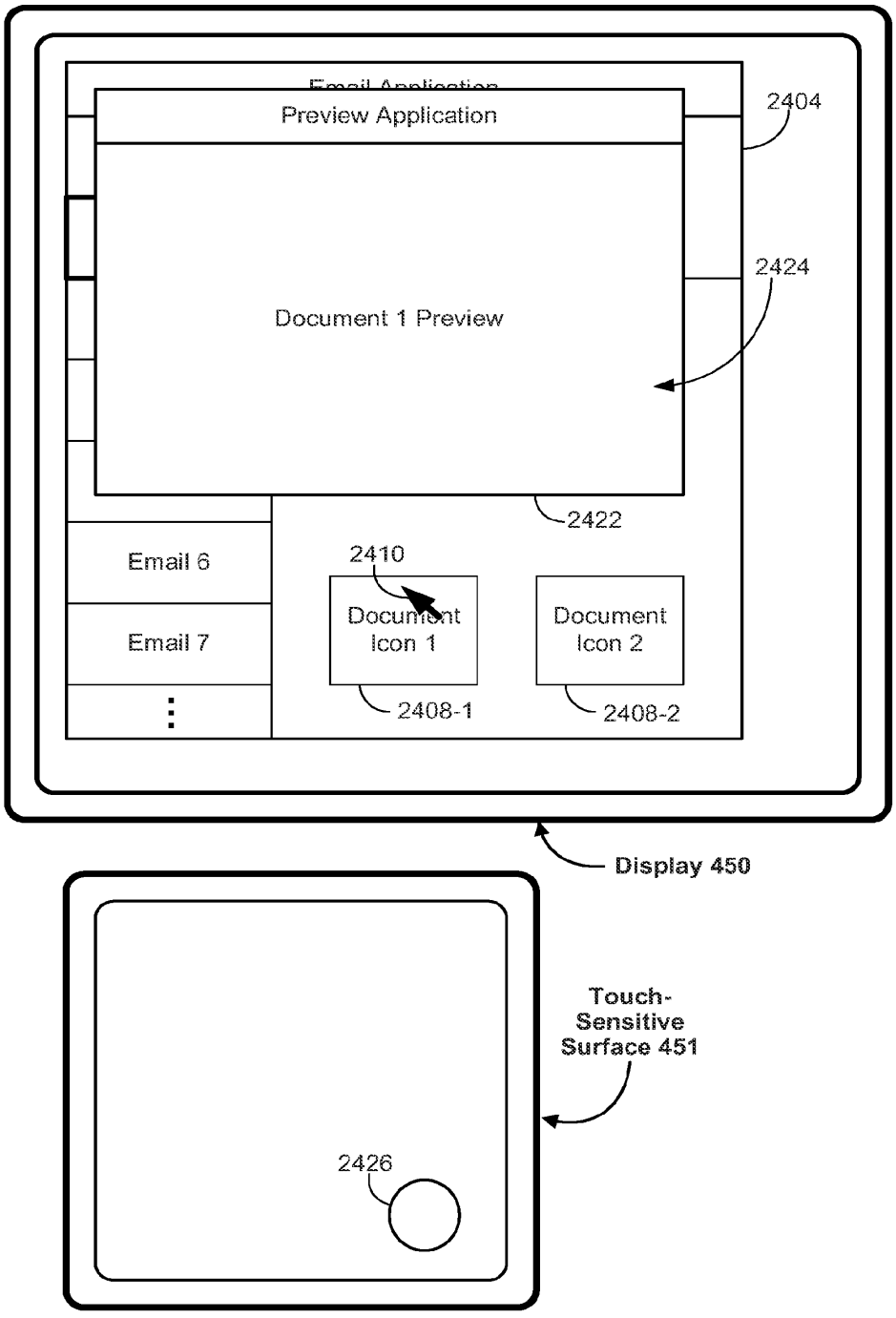

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Touch-Sensitive Surface 451
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Figure 5I

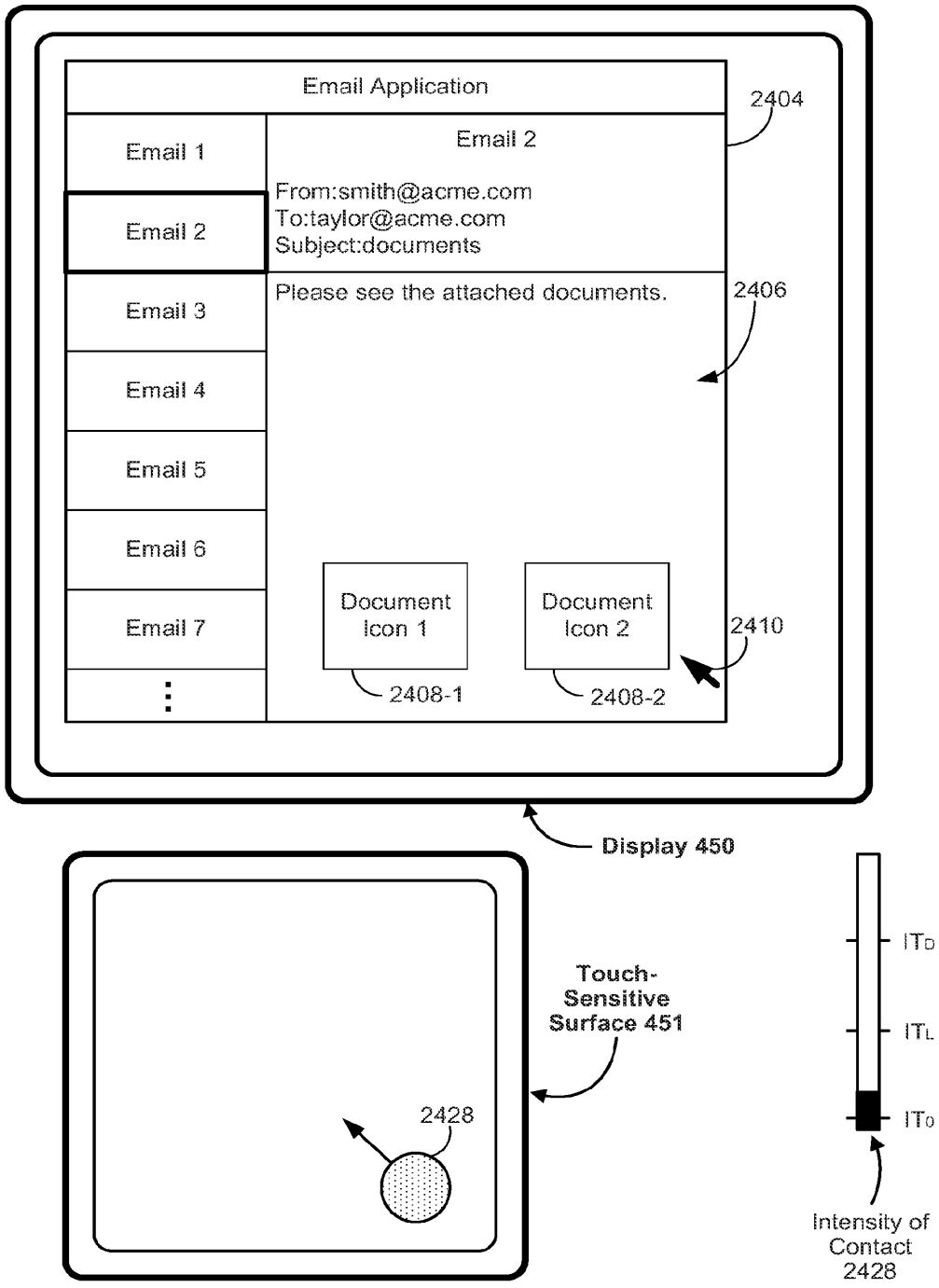

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Figure 5J

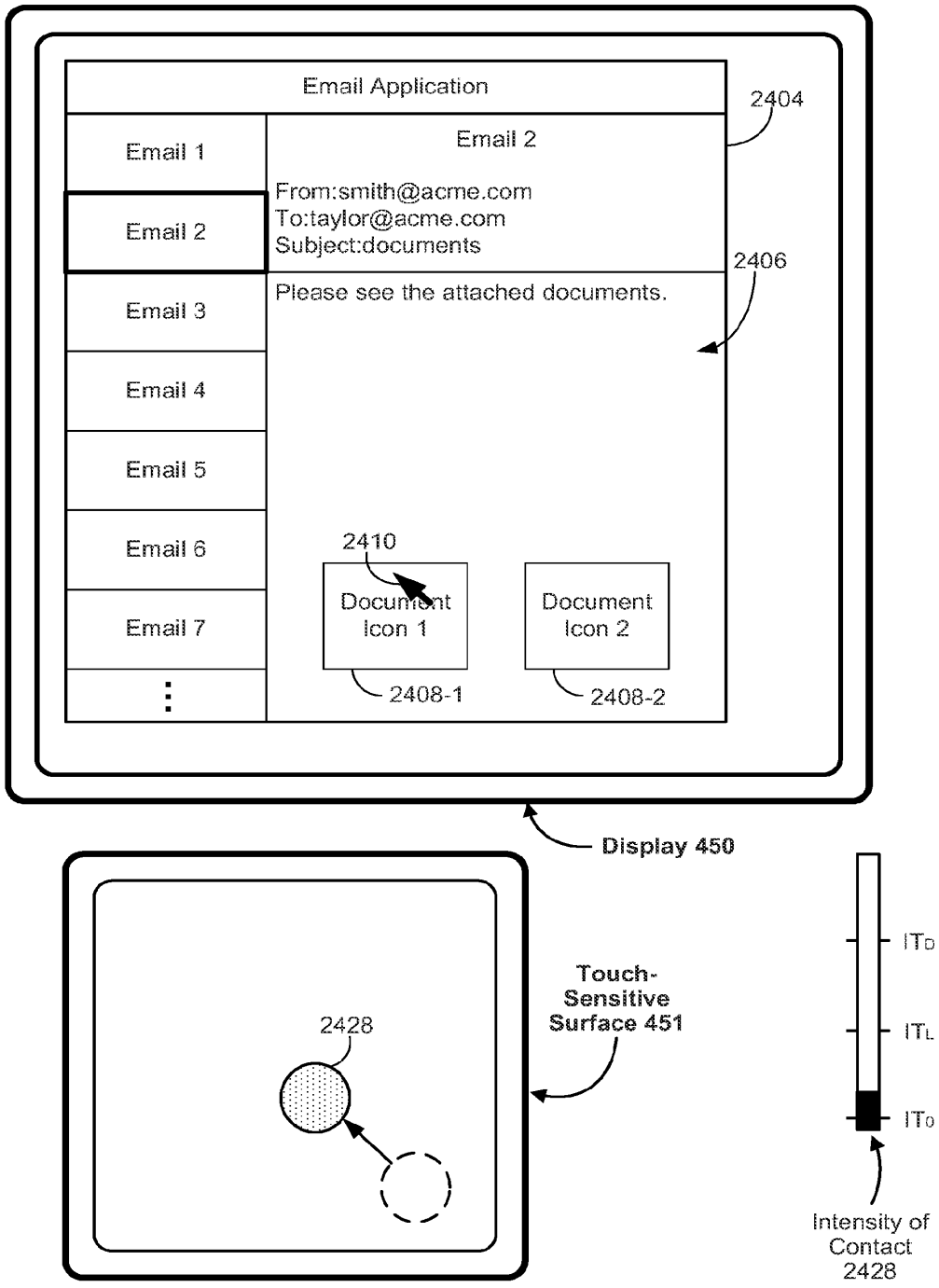

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Figure 5K

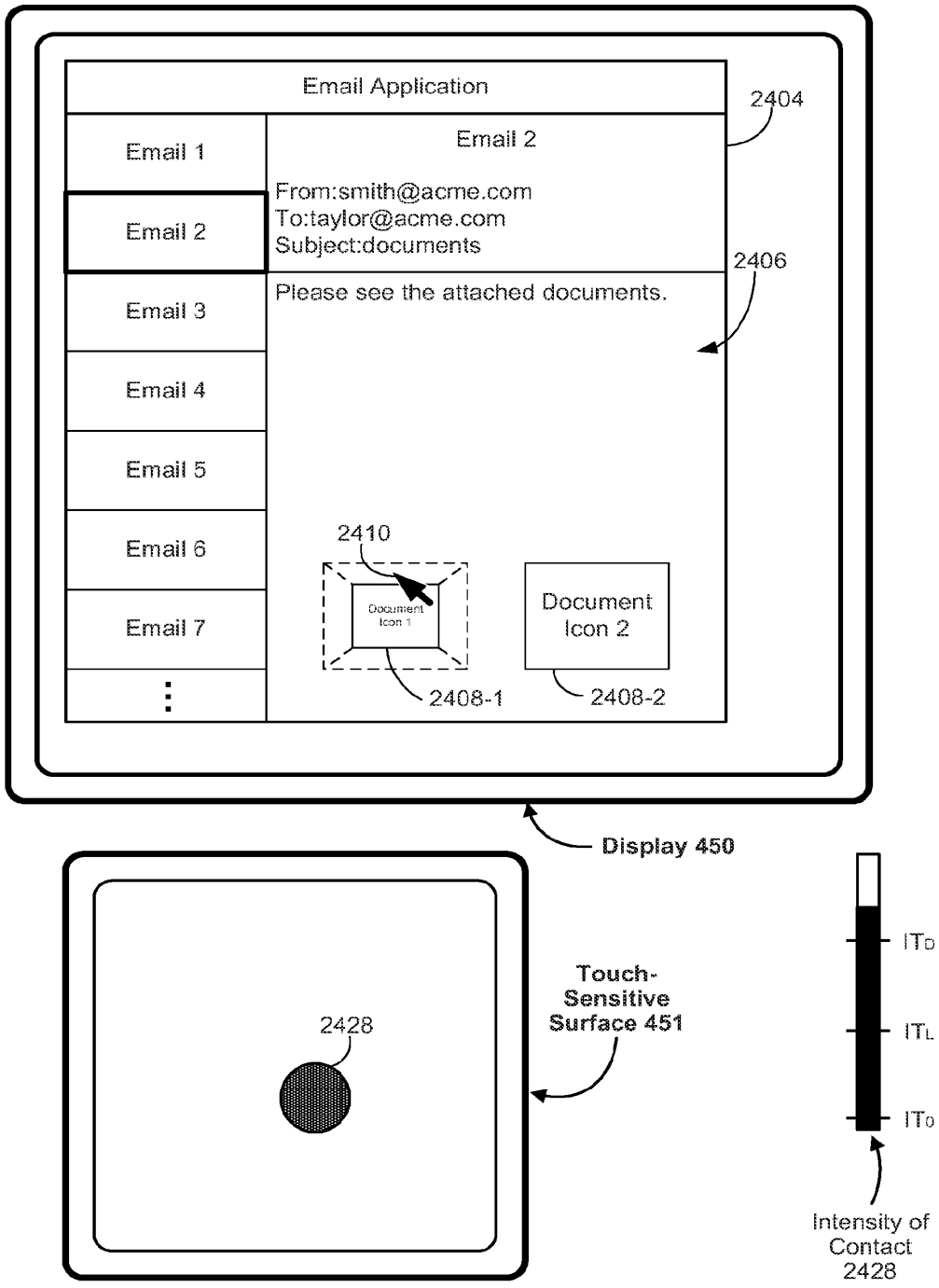

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Figure 5L

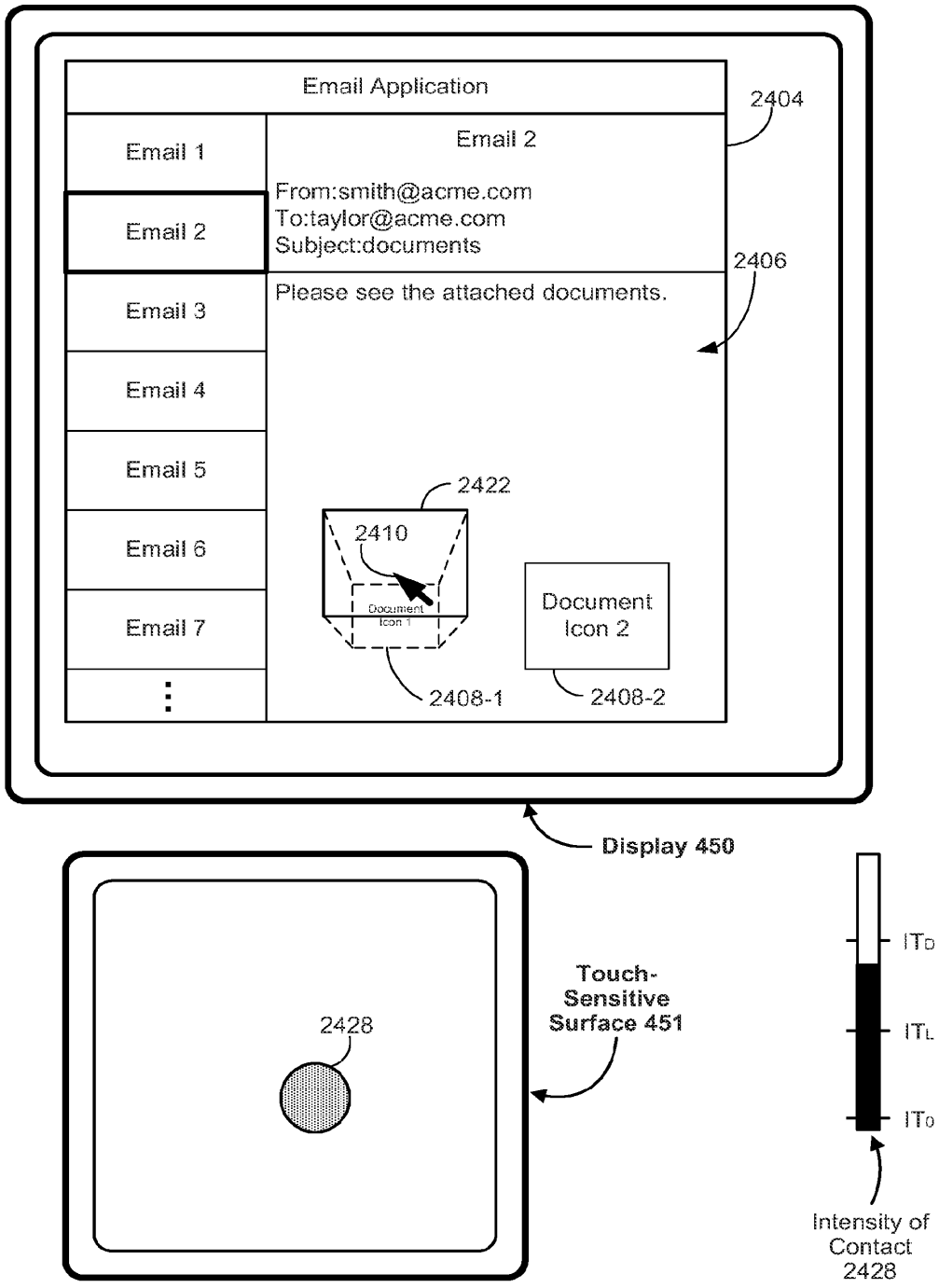

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2408-2
Display 450
Touch-Sensitive Surface 451
2428
ITD
ITL
ITD
Intensity of Contact 2428

Figure 5M

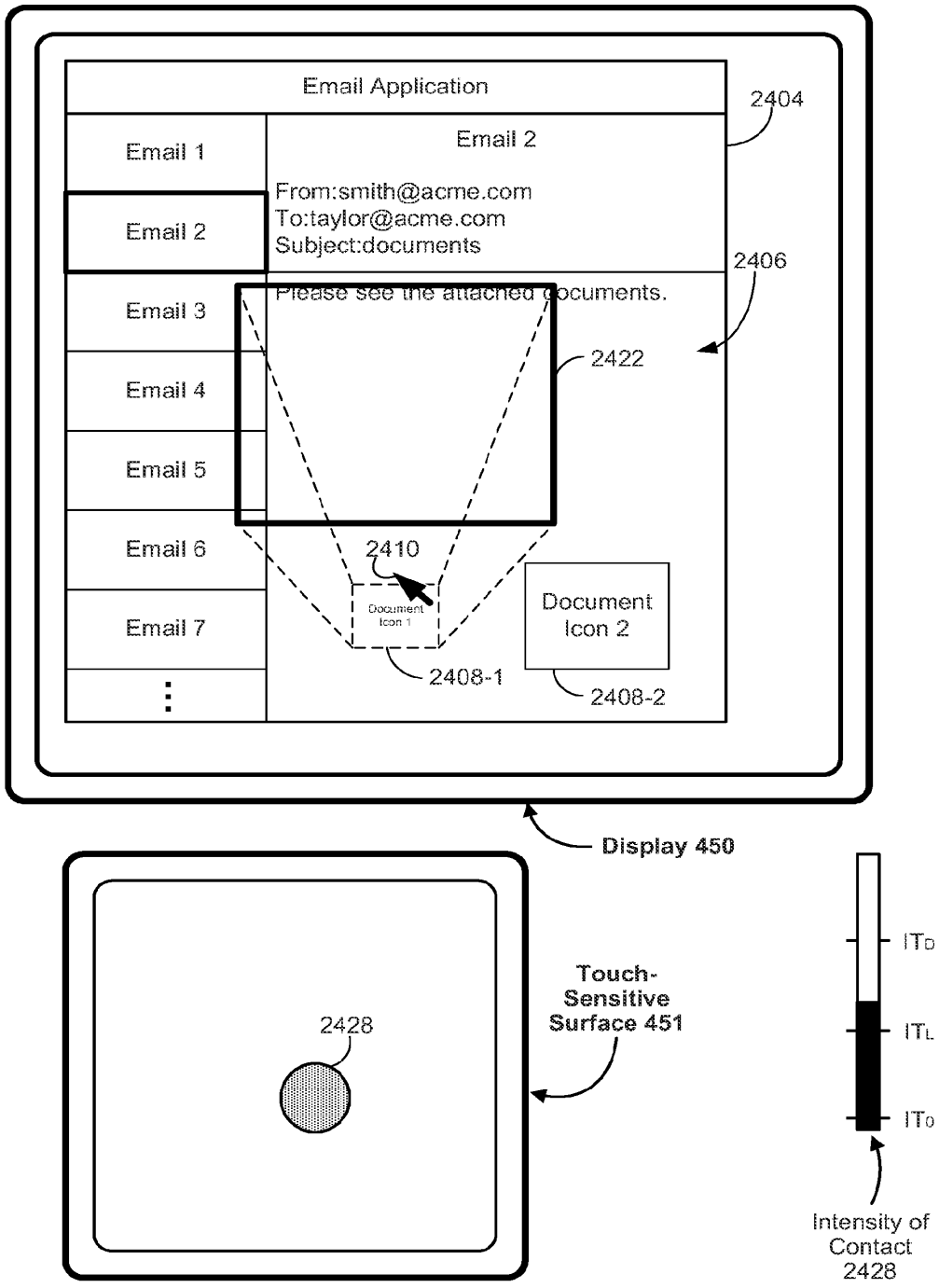

Email Application
2404
Email 1
Email 2
Email 2
From:smith@acme.com
To:taylor@acme.com
Subject:documents
2406
Email 3
Please see the attached documents.
2422
Email 4
Email 5
Email 6
2410
Email 7
Document Icon 1
Document Icon 2
2408-1
2408-2
Display 450
Touch-Sensitive Surface 451
2428
ITD
ITL
ITO
Intensity of Contact 2428

Figure 5N

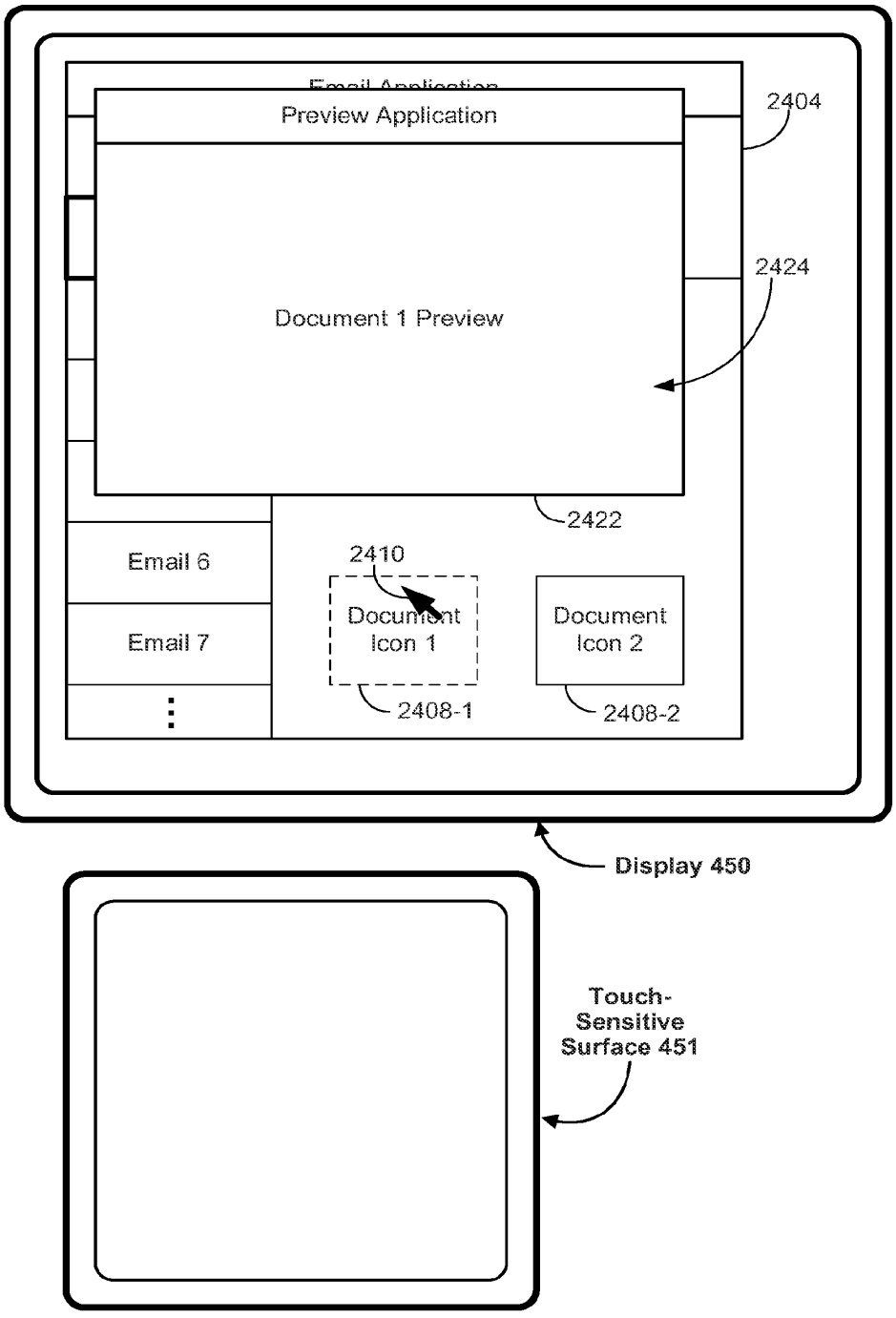

Email Application
Preview Application
2404
2424
Document 1 Preview
2422
Email 6
Email 7
2410
Document Icon 1
Document Icon 2
2408-1
2408-2
Display 450
Touch-Sensitive Surface 451

Figure 5O

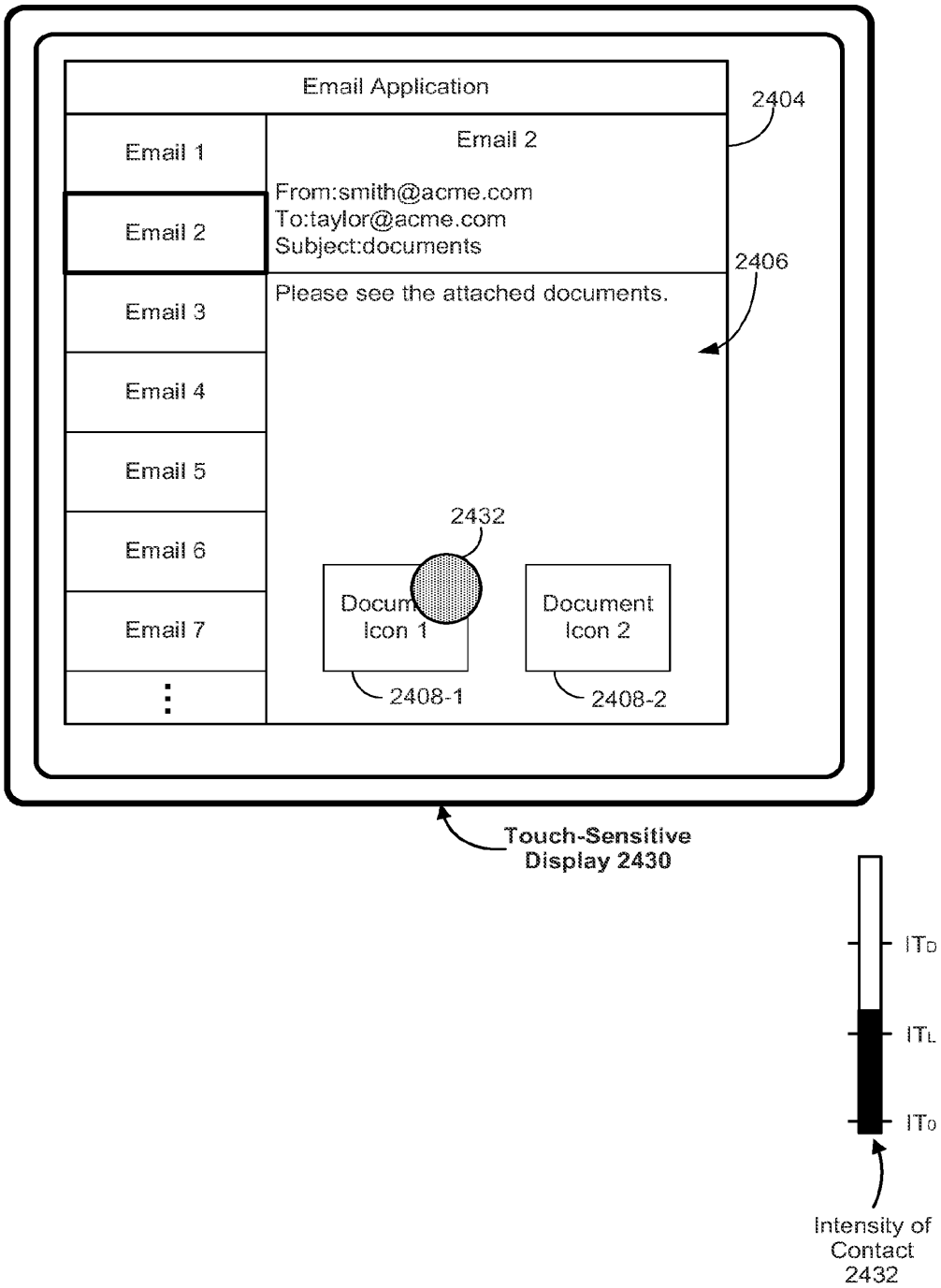

Email Application
2404
Email 1
Email 2
Email 2
From:smith@acme.com
To:taylor@acme.com
Subject:documents
2406
Email 3
Please see the attached documents.
Email 4
Email 5
2432
Email 6
Email 7
Document Icon 1
Document Icon 2
2408-1
2408-2
Touch-Sensitive Display 2430
ITD
ITL
ITO
Intensity of Contact 2432

Figure 5P

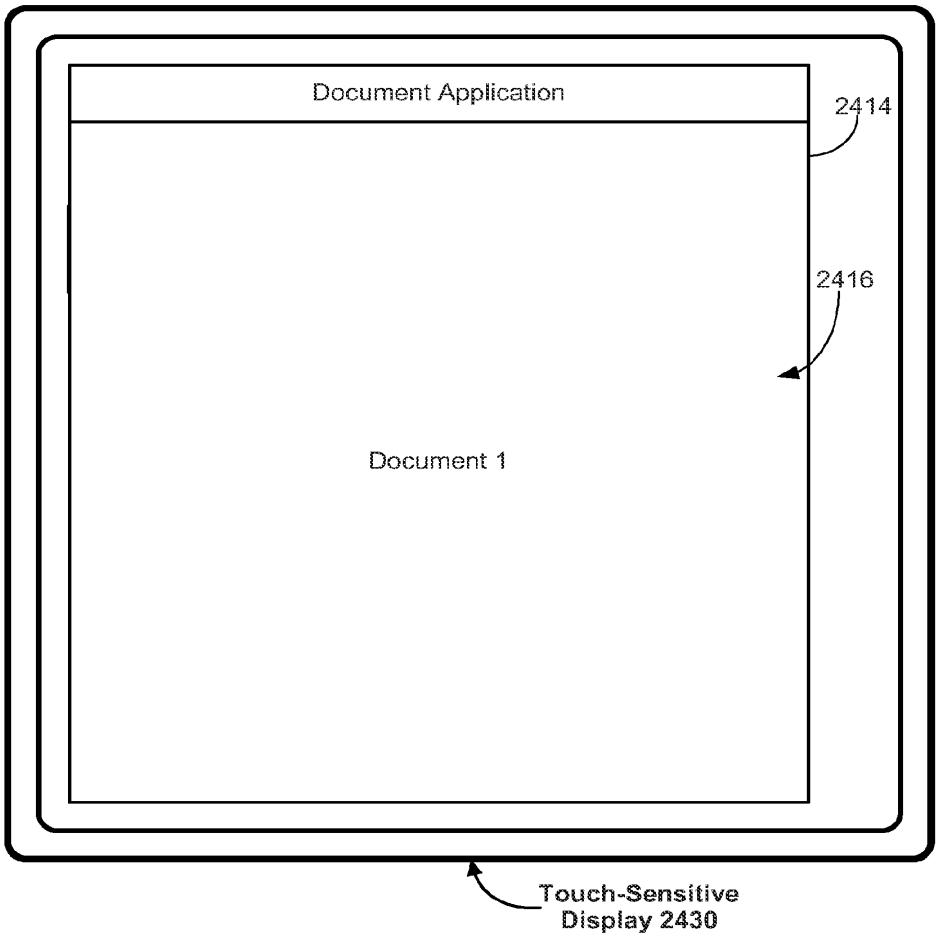

Document Application
2414
2416
Document 1
Touch-Sensitive
Display 2430

Figure 5Q

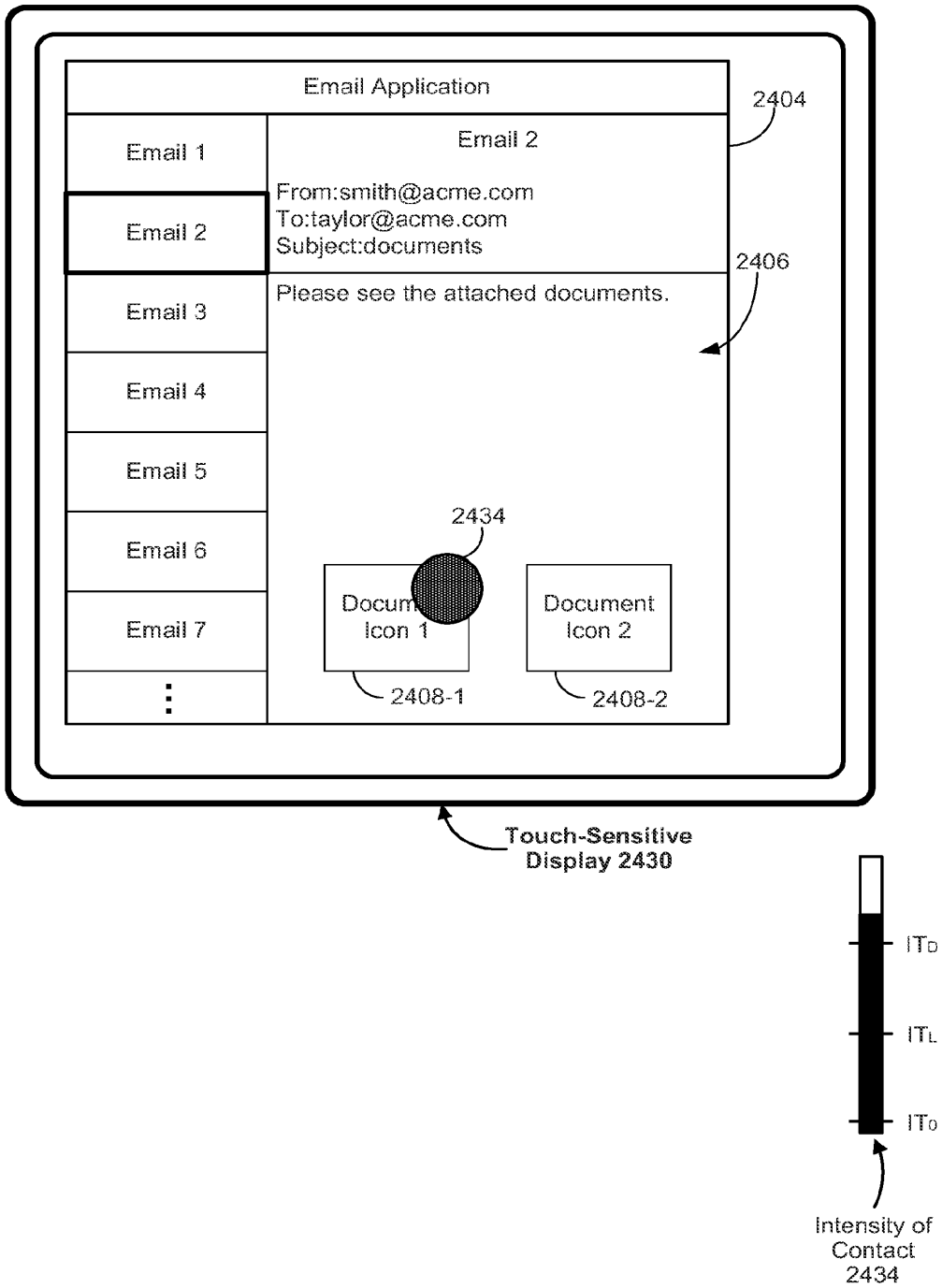

Email Application
2404
Email 1
Email 2
Email 2
From:smith@acme.com
To:taylor@acme.com
Subject:documents
2406
Email 3
Please see the attached documents.
Email 4
Email 5
2434
Email 6
Email 7
Document Icon 1
Document Icon 2
2408-1
2408-2
Touch-Sensitive Display 2430
ITD
ITL
ITO
Intensity of Contact 2434

Figure 5R

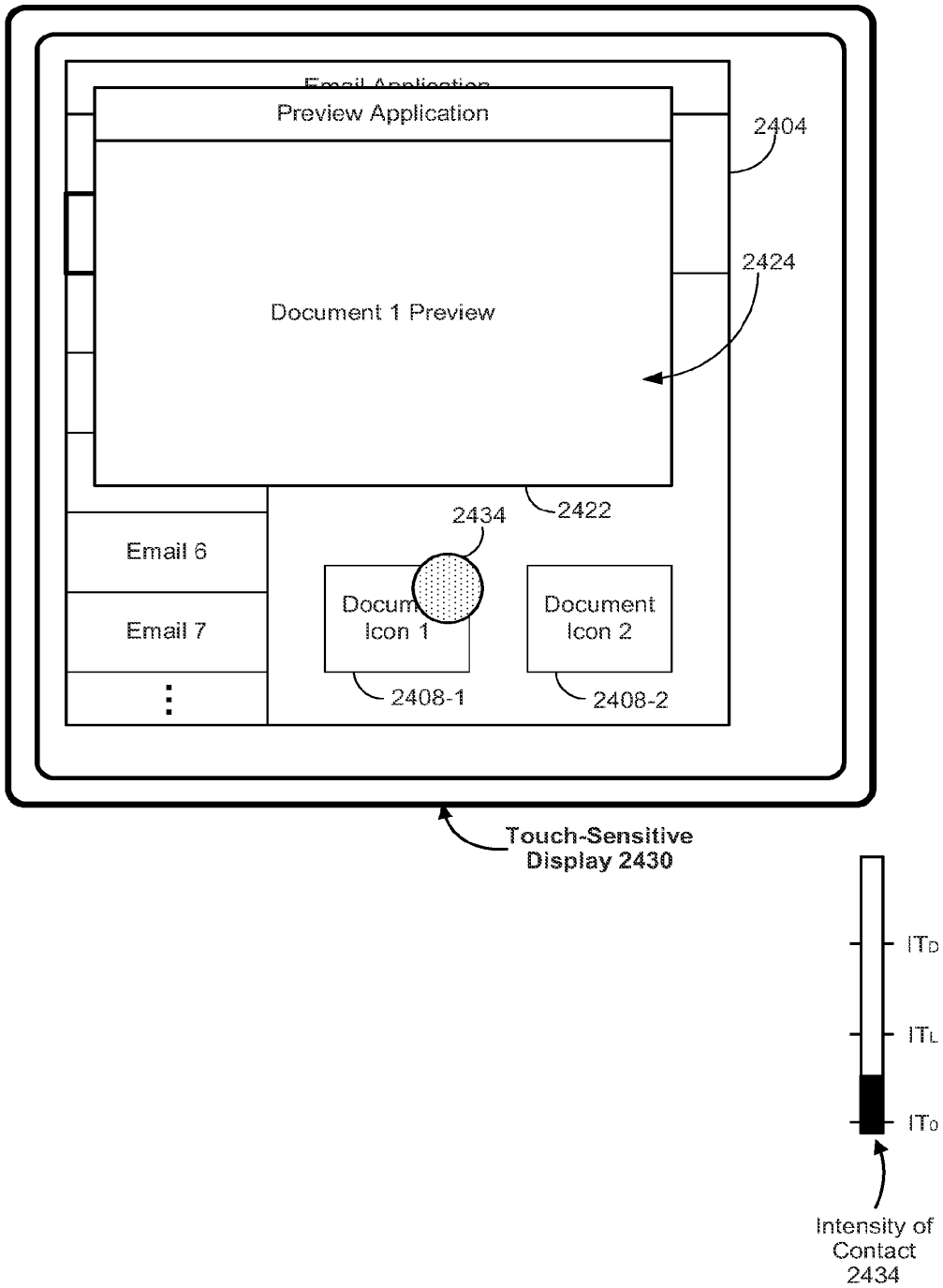

Email Application
Preview Application
2404
2424
Document 1 Preview
2422
2434
Email 6
Email 7
Docum
Icon 1
Document
Icon 2
2408-1
2408-2
Touch-Sensitive
Display 2430
ITD
ITL
ITo
Intensity of
Contact
2434

Figure 5S

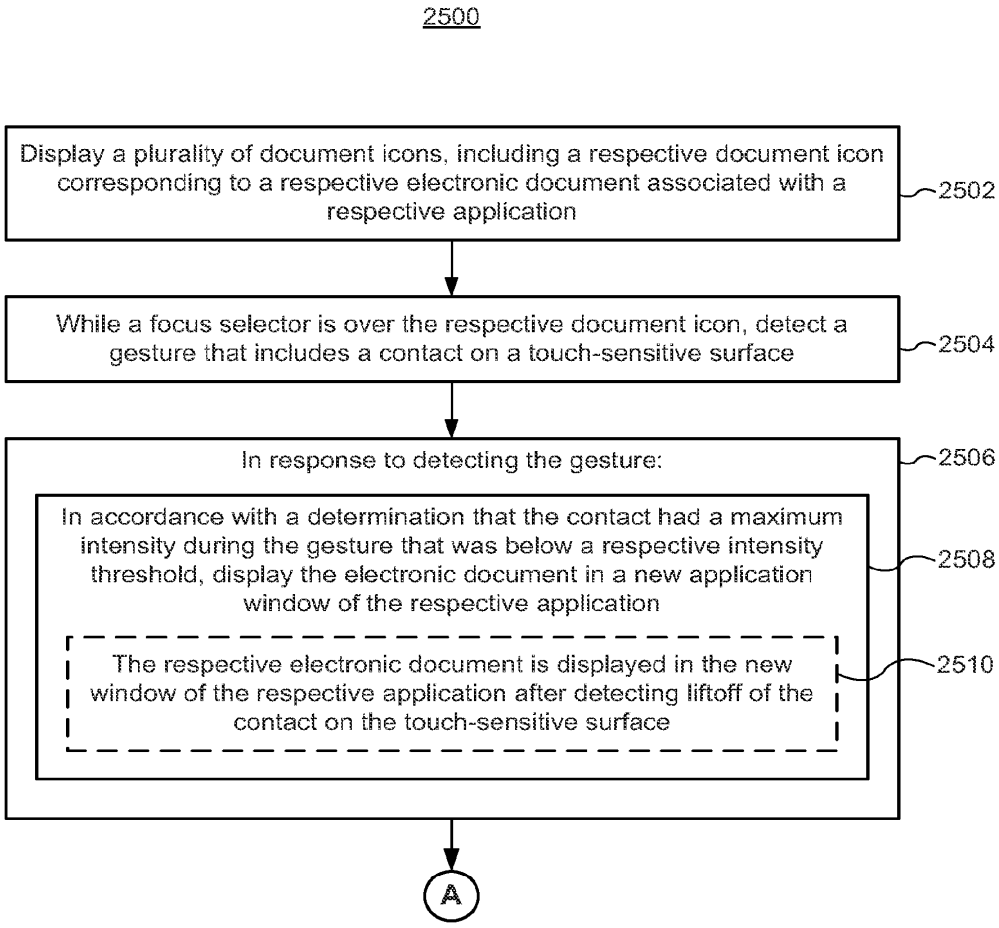

2500
Display a plurality of document icons, including a respective document icon corresponding to a respective electronic document associated with a respective application
2502
While a focus selector is over the respective document icon, detect a gesture that includes a contact on a touch-sensitive surface
2504
In response to detecting the gesture:
2506
In accordance with a determination that the contact had a maximum intensity during the gesture that was below a respective intensity threshold, display the electronic document in a new application window of the respective application
2508
The respective electronic document is displayed in the new window of the respective application after detecting liftoff of the contact on the touch-sensitive surface
2510
A

Figure 6A

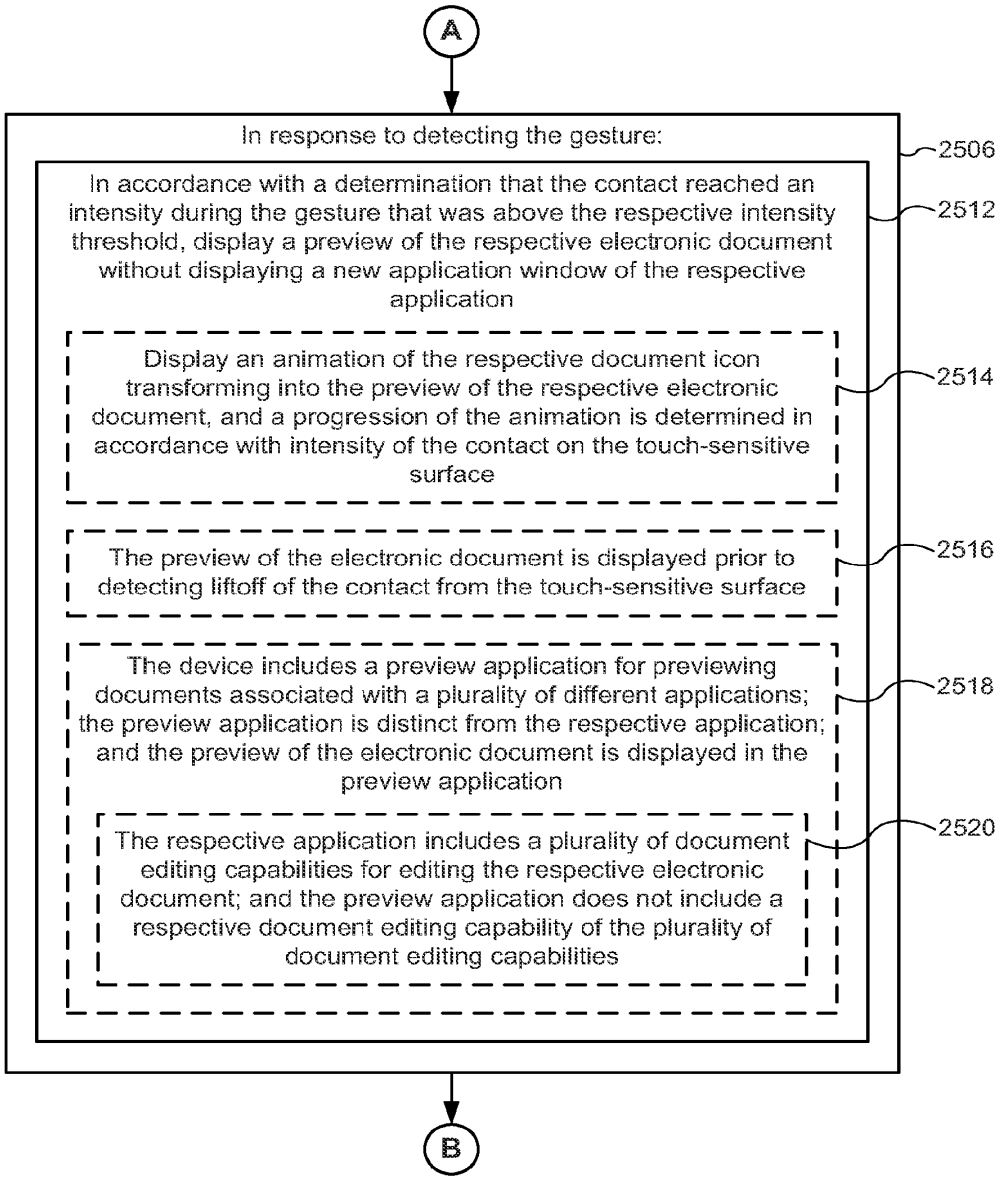

A
In response to detecting the gesture:
2506
In accordance with a determination that the contact reached an intensity during the gesture that was above the respective intensity threshold, display a preview of the respective electronic document without displaying a new application window of the respective application
2512
Display an animation of the respective document icon transforming into the preview of the respective electronic document, and a progression of the animation is determined in accordance with intensity of the contact on the touch-sensitive surface
2514
The preview of the electronic document is displayed prior to detecting liftoff of the contact from the touch-sensitive surface
2516
The device includes a preview application for previewing documents associated with a plurality of different applications; the preview application is distinct from the respective application; and the preview of the electronic document is displayed in the preview application
2518
The respective application includes a plurality of document editing capabilities for editing the respective electronic document; and the preview application does not include a respective document editing capability of the plurality of document editing capabilities
2520
B

Figure 6B

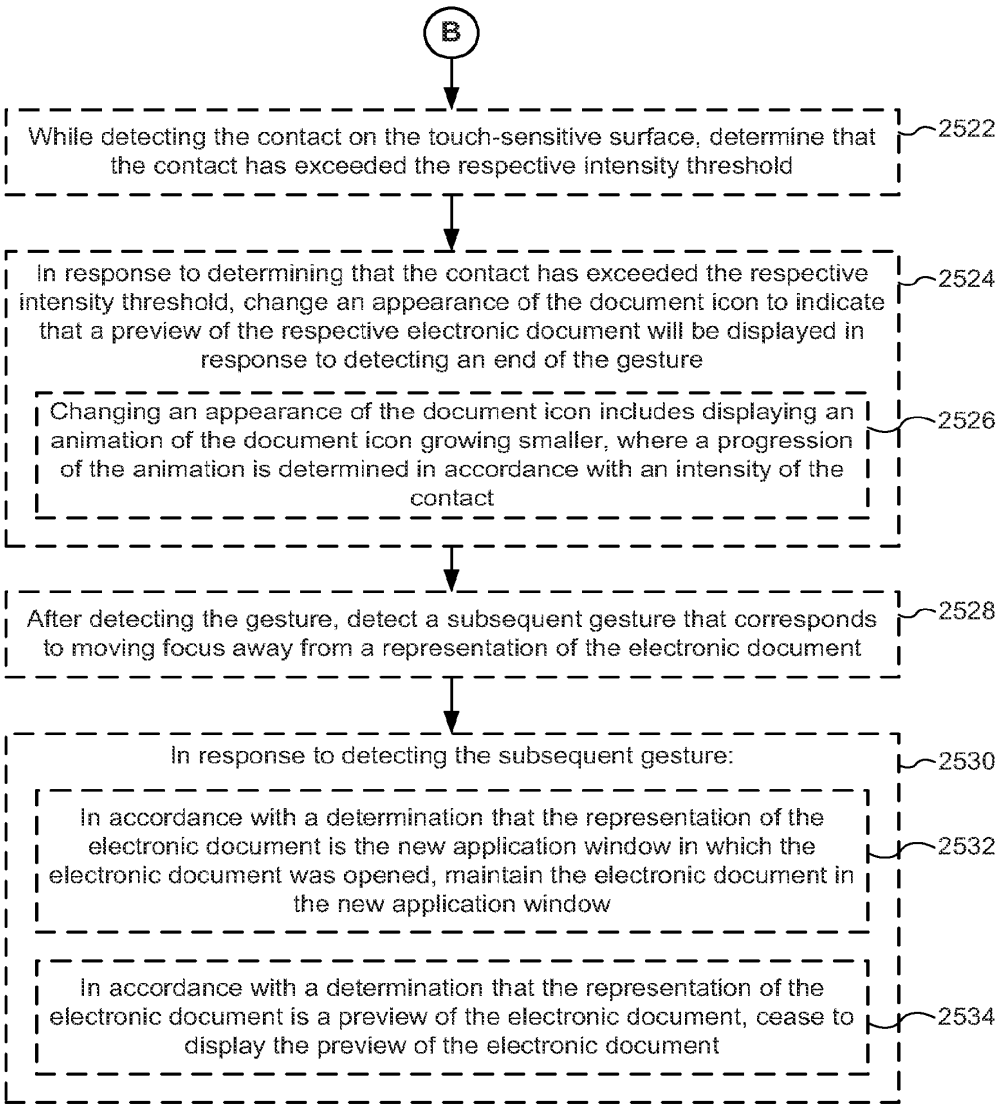

B
While detecting the contact on the touch-sensitive surface, determine that the contact has exceeded the respective intensity threshold
2522
In response to determining that the contact has exceeded the respective intensity threshold, change an appearance of the document icon to indicate that a preview of the respective electronic document will be displayed in response to detecting an end of the gesture
2524
Changing an appearance of the document icon includes displaying an animation of the document icon growing smaller, where a progression of the animation is determined in accordance with an intensity of the contact
2526
After detecting the gesture, detect a subsequent gesture that corresponds to moving focus away from a representation of the electronic document
2528
In response to detecting the subsequent gesture:
2530
In accordance with a determination that the representation of the electronic document is the new application window in which the electronic document was opened, maintain the electronic document in the new application window
2532
In accordance with a determination that the representation of the electronic document is a preview of the electronic document, cease to display the preview of the electronic document
2534

Figure 6C

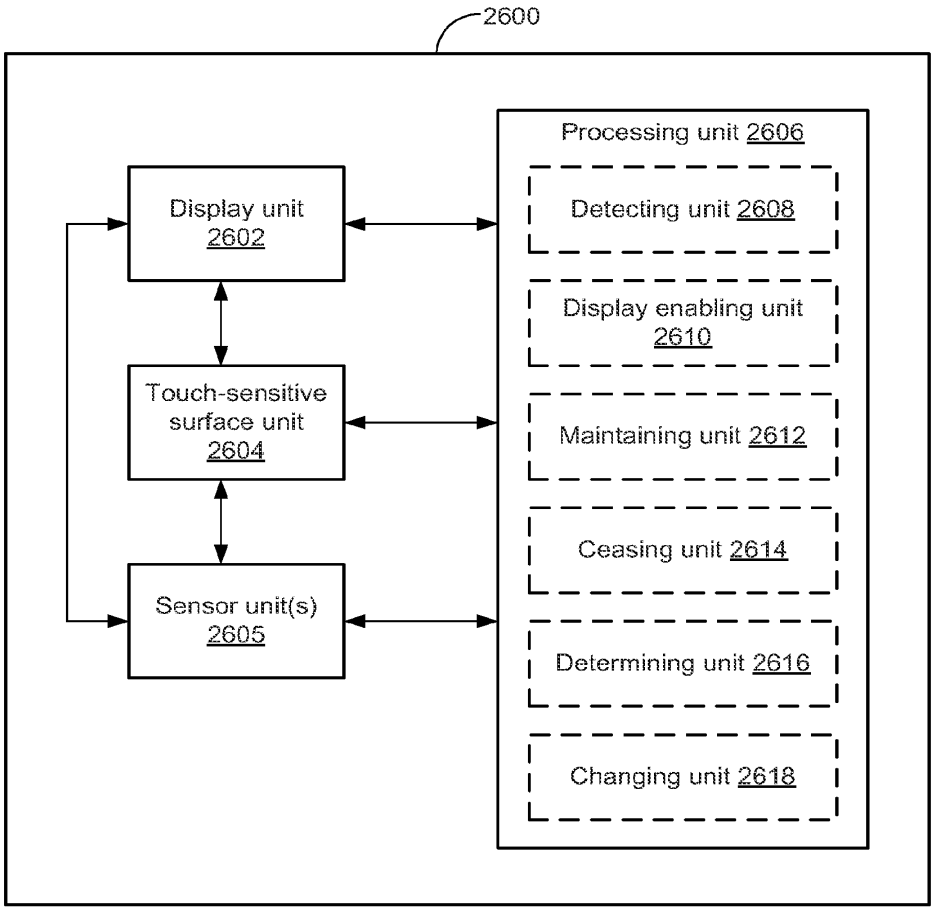
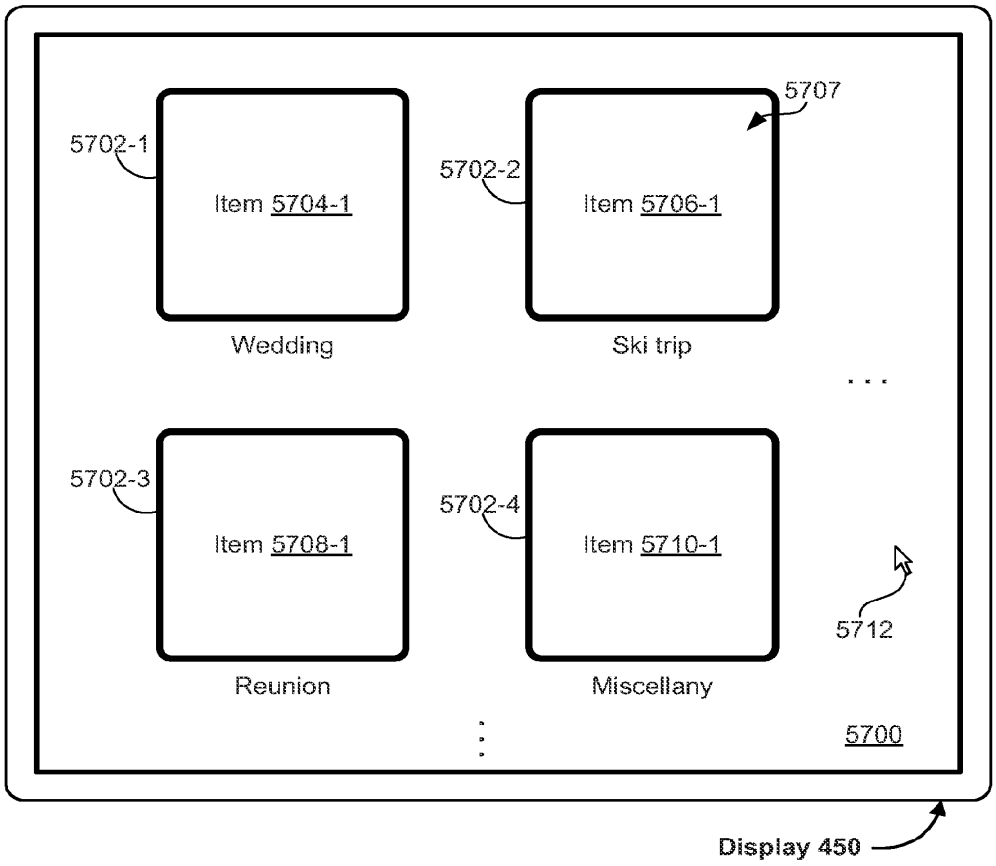

2600
Processing unit 2606
Display unit 2602
Detecting unit 2608
Display enabling unit 2610
Touch-sensitive surface unit 2604
Maintaining unit 2612
Ceasing unit 2614
Sensor unit(s) 2605
Determining unit 2616
Changing unit 2618

Figure 7


5707
5702-1
Item 5704-1
Wedding
5702-2
Item 5706-1
Ski trip
5702-3
Item 5708-1
Reunion
5702-4
Item 5710-1
Miscellany
5712
5700
Display 450

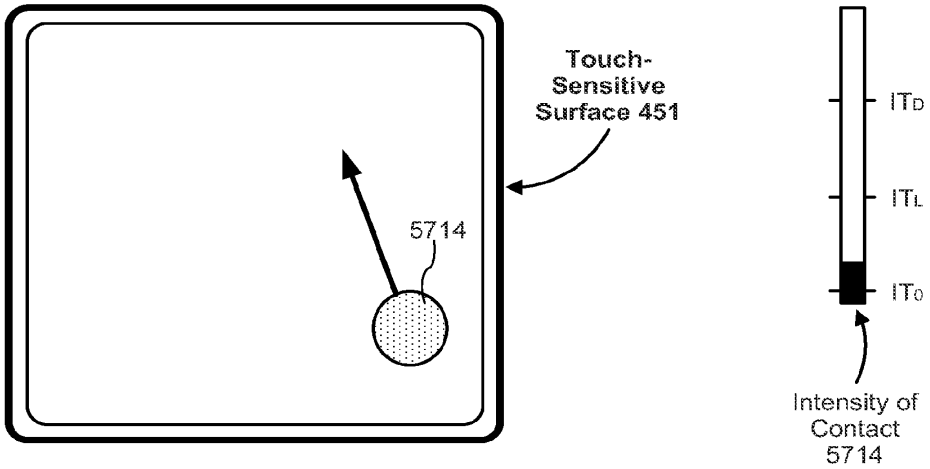

Touch-Sensitive Surface 451
5714
ITD
ITL
IT0
Intensity of Contact 5714

Figure 8A

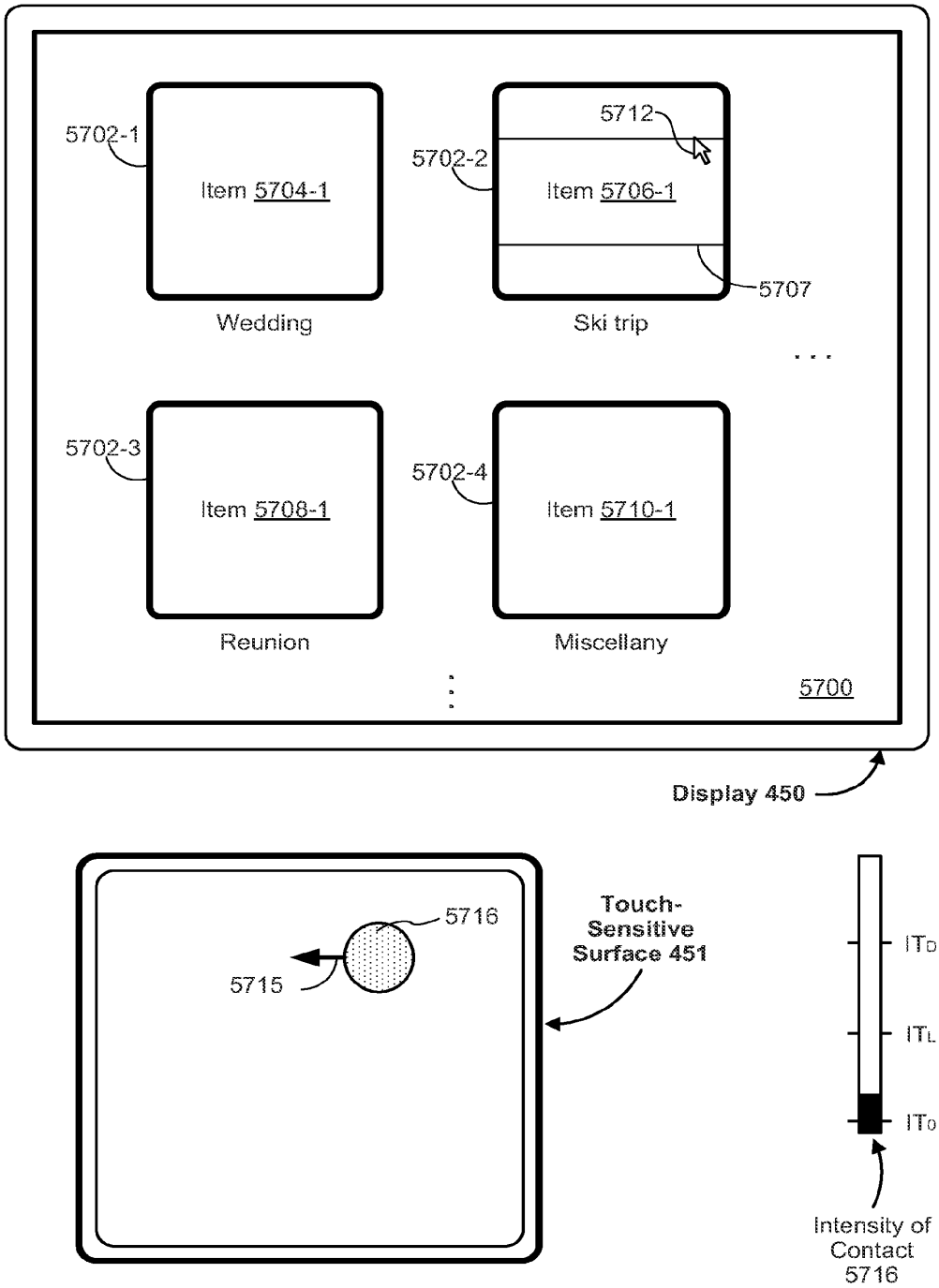
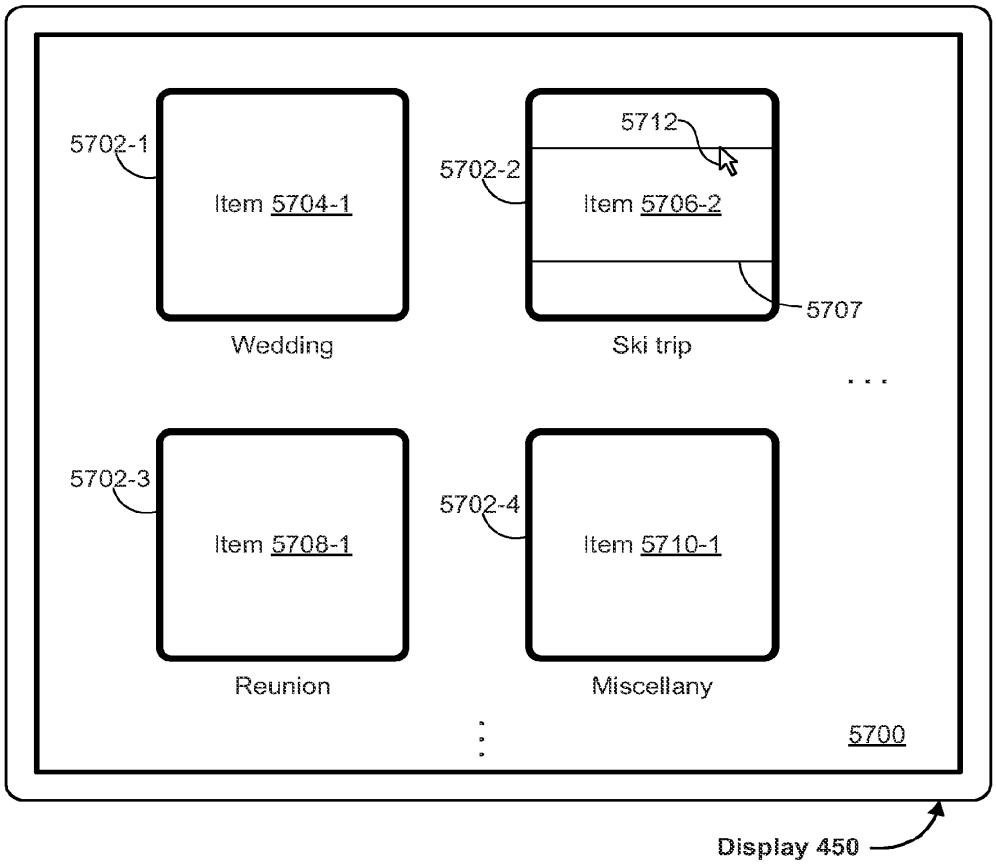

5702-1
Item 5704-1
Wedding
5712
5702-2
Item 5706-1
5707
Ski trip
5702-3
Item 5708-1
Reunion
5702-4
Item 5710-1
Miscellany
5700
Display 450
5716
5715
Touch-Sensitive Surface 451
ITD
ITL
IT0
Intensity of Contact 5716

Figure 8B


5702-1
Item 5704-1
Wedding
5712
5702-2
Item 5706-2
5707
Ski trip
5702-3
Item 5708-1
Reunion
5702-4
Item 5710-1
Miscellany
5700
Display 450

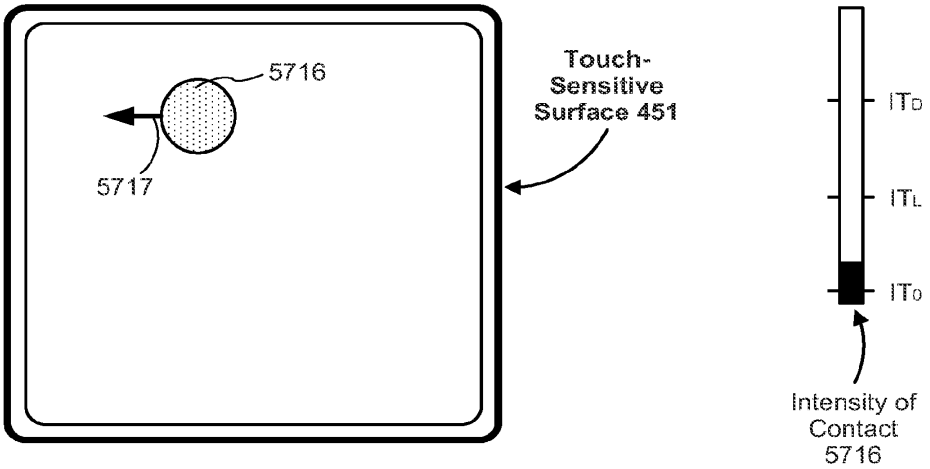

5716
5717
Touch-Sensitive Surface 451
ITD
ITL
IT0
Intensity of Contact 5716

Figure 8C

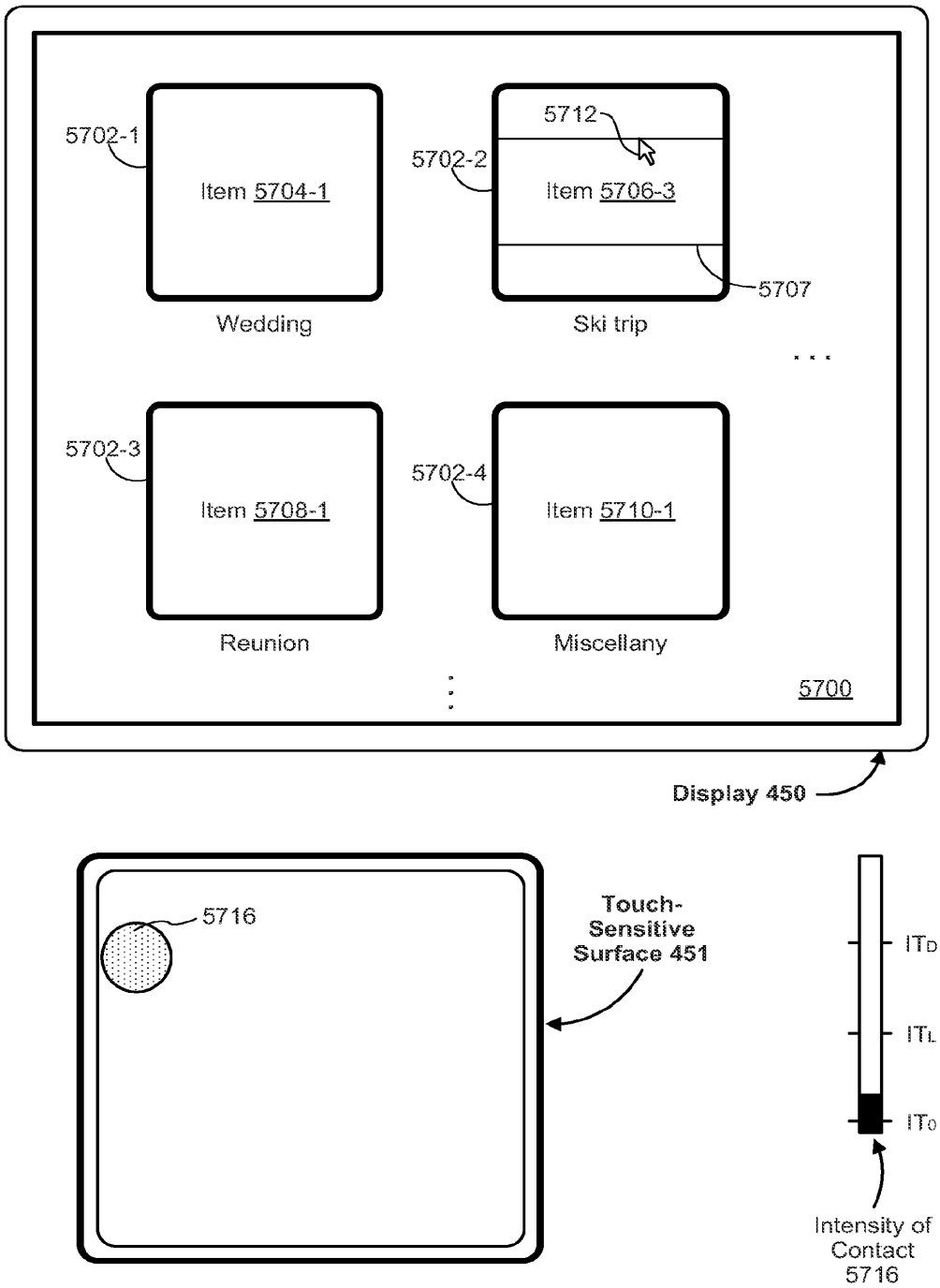

5702-1
Item 5704-1
Wedding
5712
5702-2
Item 5706-3
5707
Ski trip
5702-3
Item 5708-1
Reunion
5702-4
Item 5710-1
Miscellany
5700
Display 450
5716
Touch-Sensitive Surface 451
ITD
ITL
IT0
Intensity of Contact 5716

Figure 8D

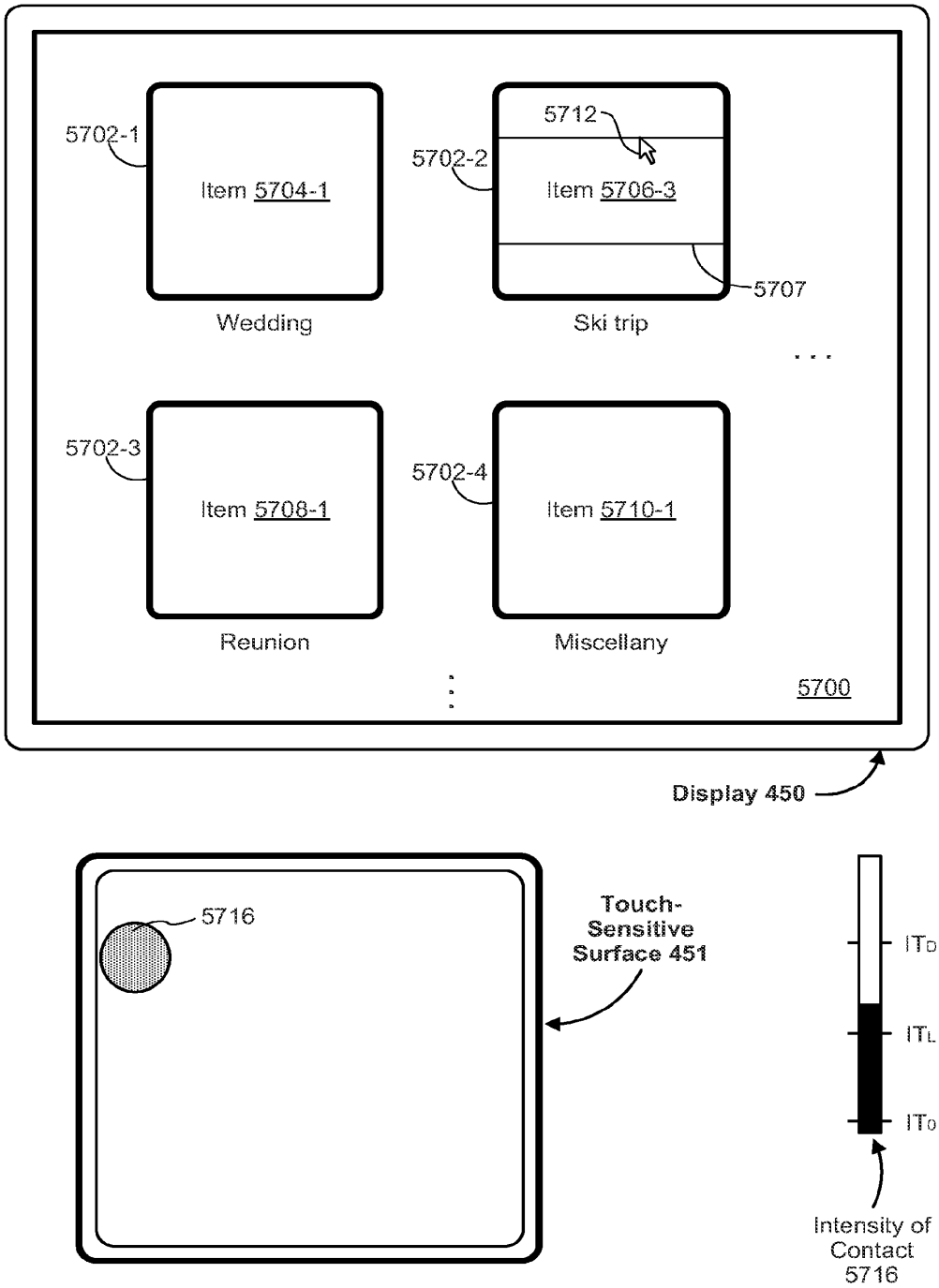

5702-1
Item 5704-1
Wedding
5712
5702-2
Item 5706-3
5707
Ski trip
5702-3
Item 5708-1
Reunion
5702-4
Item 5710-1
Miscellany
5700
Display 450
5716
Touch-Sensitive Surface 451
ITD
ITL
ITO
Intensity of Contact 5716

Figure 8E

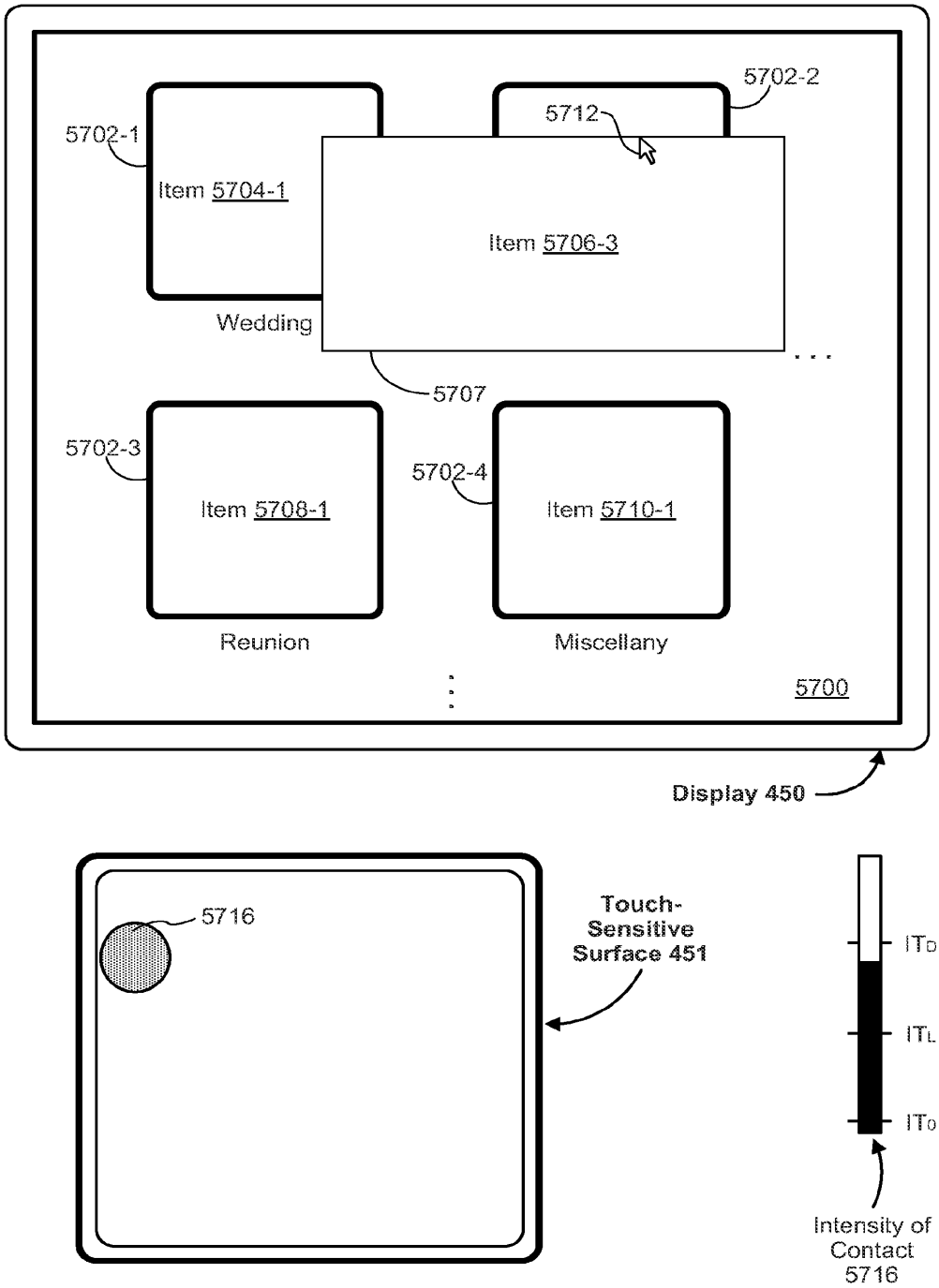

5702-2
5712
5702-1
Item 5704-1
Item 5706-3
Wedding
5707
5702-3
Item 5708-1
5702-4
Item 5710-1
Reunion
Miscellany
5700
Display 450
5716
Touch-Sensitive Surface 451
ITD
ITL
ITo
Intensity of Contact 5716

Figure 8F

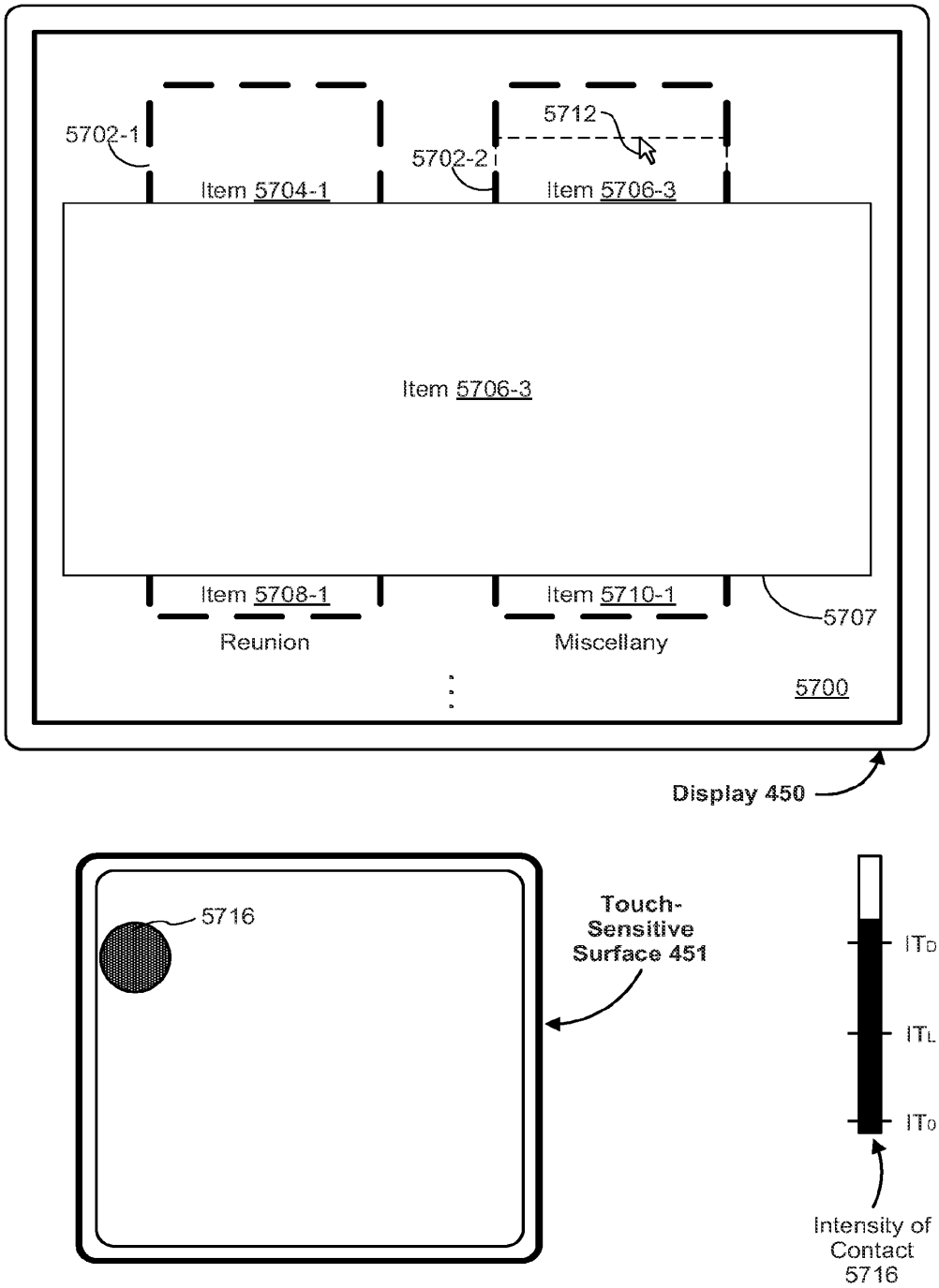
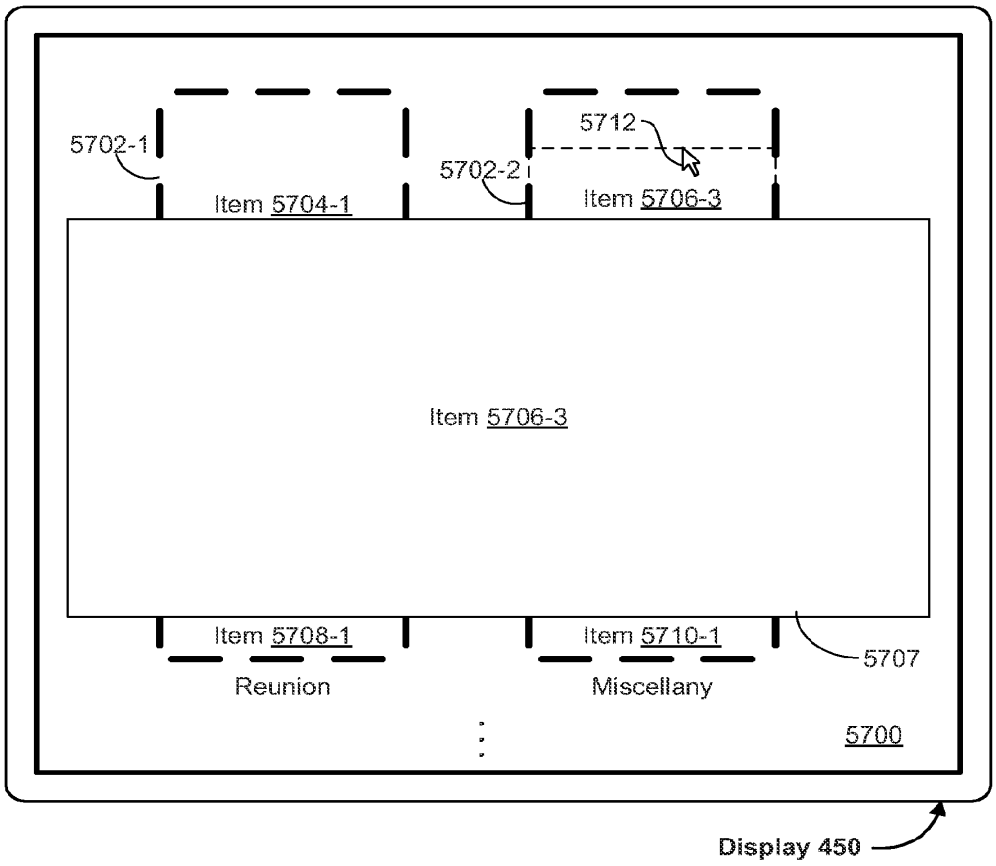

5702-1
5712
5702-2
Item 5704-1
Item 5706-3
Item 5706-3
Item 5708-1
Item 5710-1
5707
Reunion
Miscellany
5700
Display 450
5716
Touch-Sensitive Surface 451
ITD
ITL
ITD
Intensity of Contact 5716

Figure 8G


5702-1
5712
5702-2
Item 5704-1
Item 5706-3
Item 5706-3
Item 5708-1
Item 5710-1
5707
Reunion
Miscellany
5700
Display 450

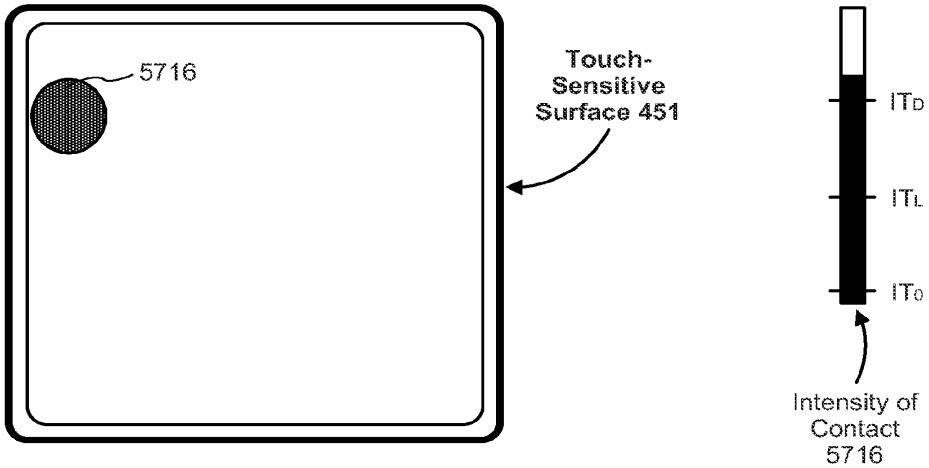

5716
Touch-Sensitive Surface 451
ITD
ITL
ITO
Intensity of Contact 5716

Figure 8H

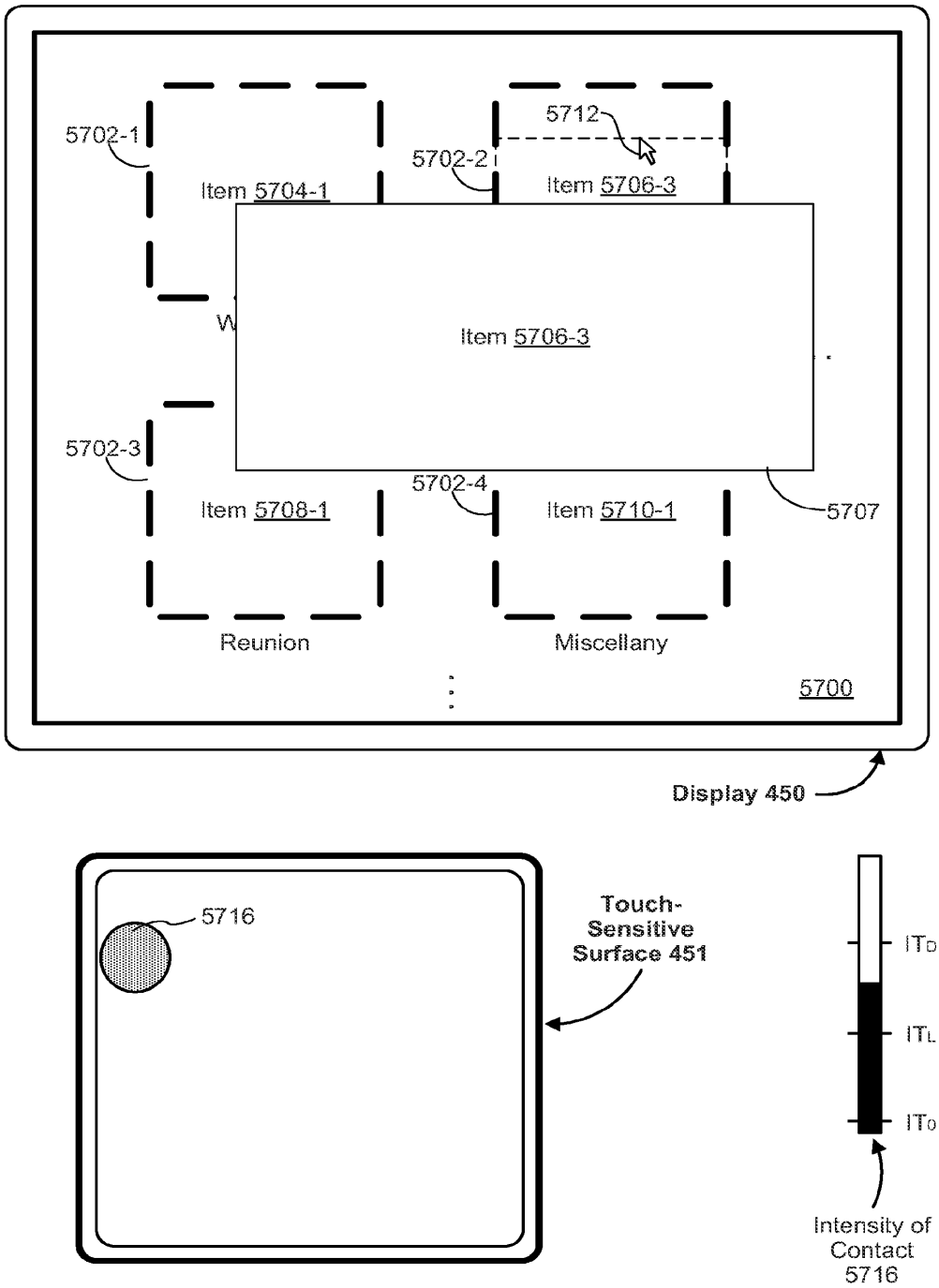

5702-1
5712
5702-2
Item 5704-1
Item 5706-3
Item 5706-3
5702-3
5702-4
Item 5708-1
Item 5710-1
5707
Reunion
Miscellany
5700
Display 450
5716
Touch-Sensitive Surface 451
ITD
ITL
ITO
Intensity of Contact 5716

Figure 8I

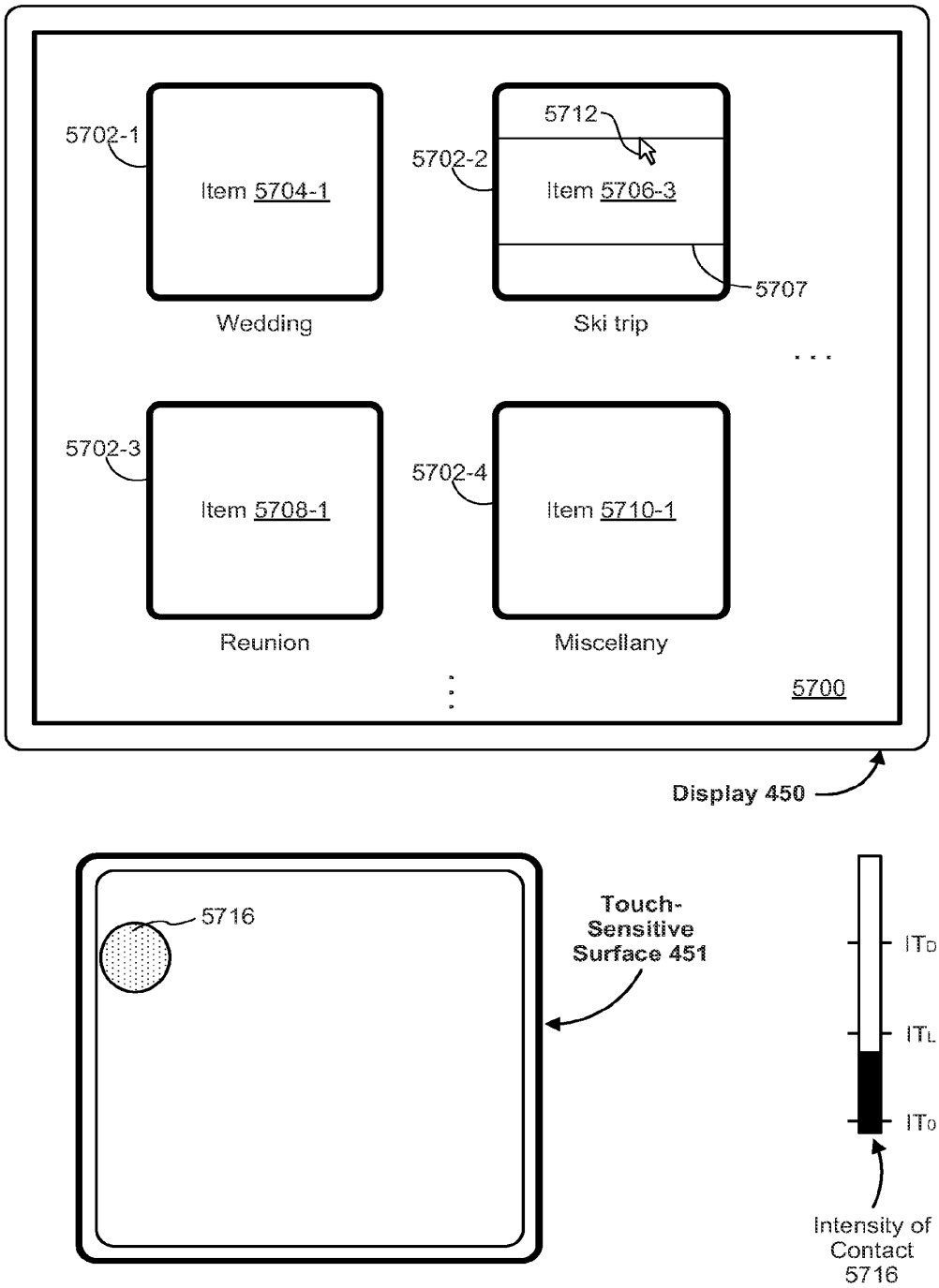
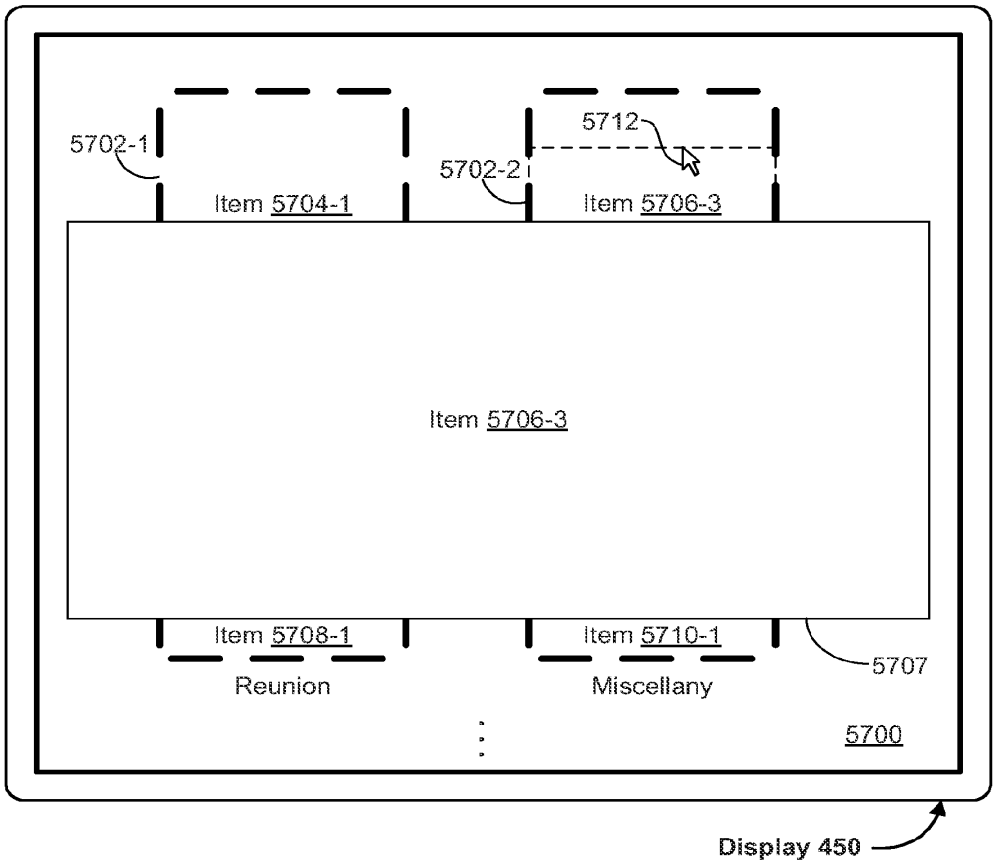

5702-1
Item 5704-1
Wedding
5712
5702-2
Item 5706-3
5707
Ski trip
5702-3
Item 5708-1
Reunion
5702-4
Item 5710-1
Miscellany
5700
Display 450
5716
Touch-Sensitive Surface 451
ITD
ITL
ITD
Intensity of Contact 5716

Figure 8J


5702-1
5712
5702-2
Item 5704-1
Item 5706-3
Item 5706-3
Item 5708-1
Item 5710-1
5707
Reunion
Miscellany
5700
Display 450

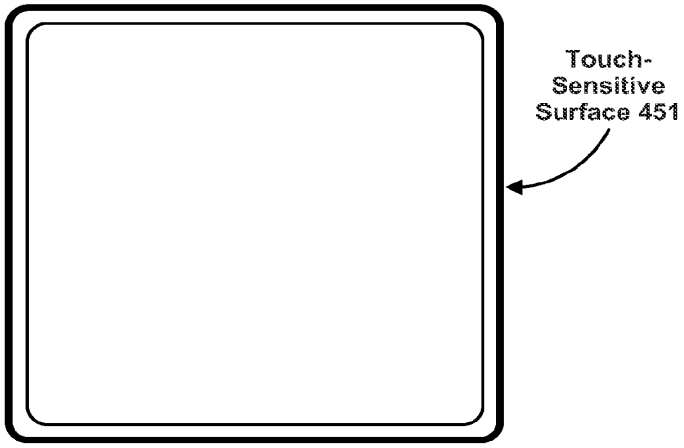

Touch-
Sensitive
Surface 451

Figure 8K

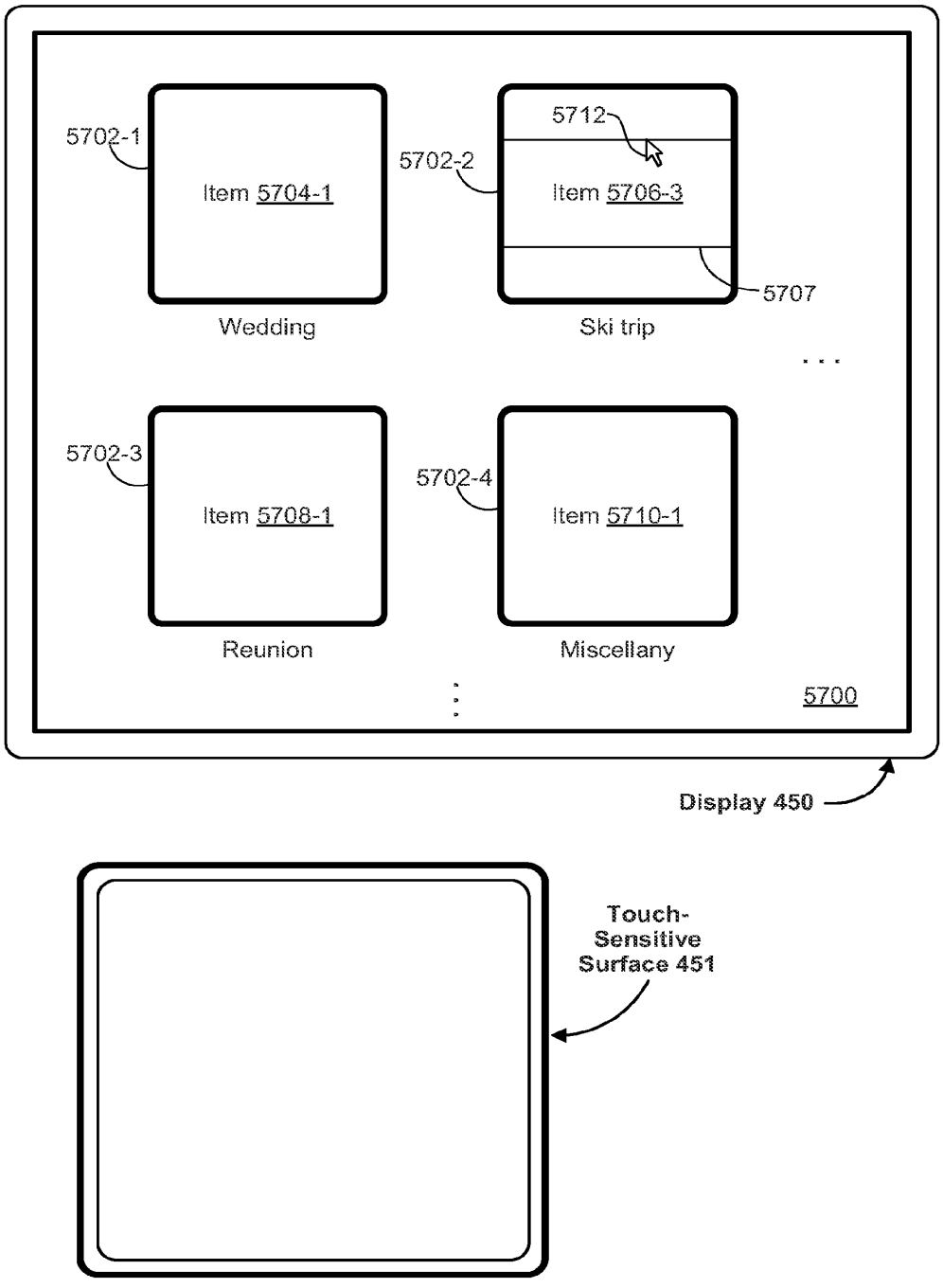

5702-1
Item 5704-1
Wedding
5712
5702-2
Item 5706-3
5707
Ski trip
5702-3
Item 5708-1
Reunion
5702-4
Item 5710-1
Miscellany
5700
Display 450
Touch-Sensitive Surface 451

Figure 8L

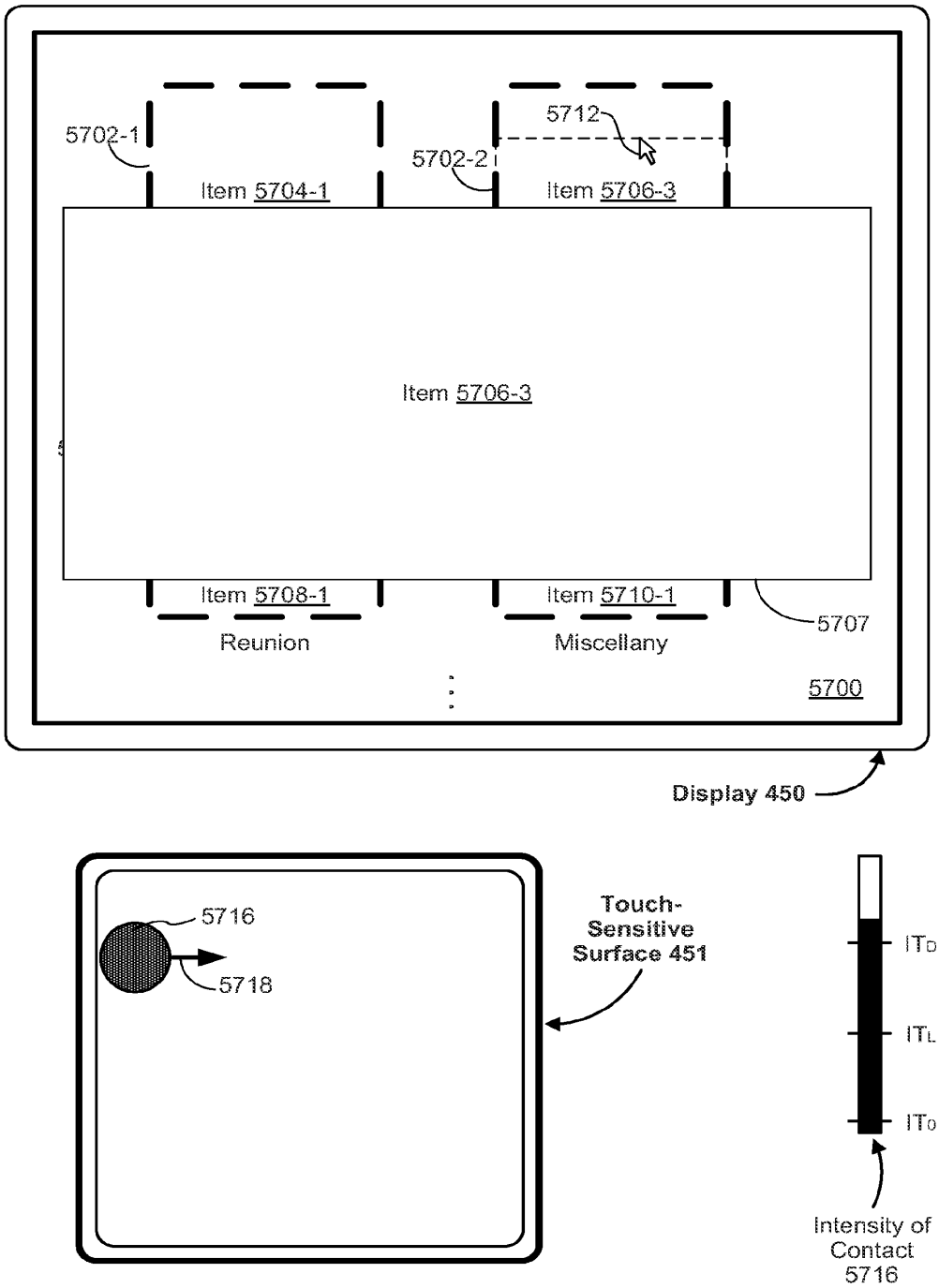

5702-1
5712
5702-2
Item 5704-1
Item 5706-3
Item 5706-3
Item 5708-1
Item 5710-1
5707
Reunion
Miscellany
5700
Display 450
5716
5718
Touch-Sensitive Surface 451
ITD
ITL
ITO
Intensity of Contact 5716

Figure 8M

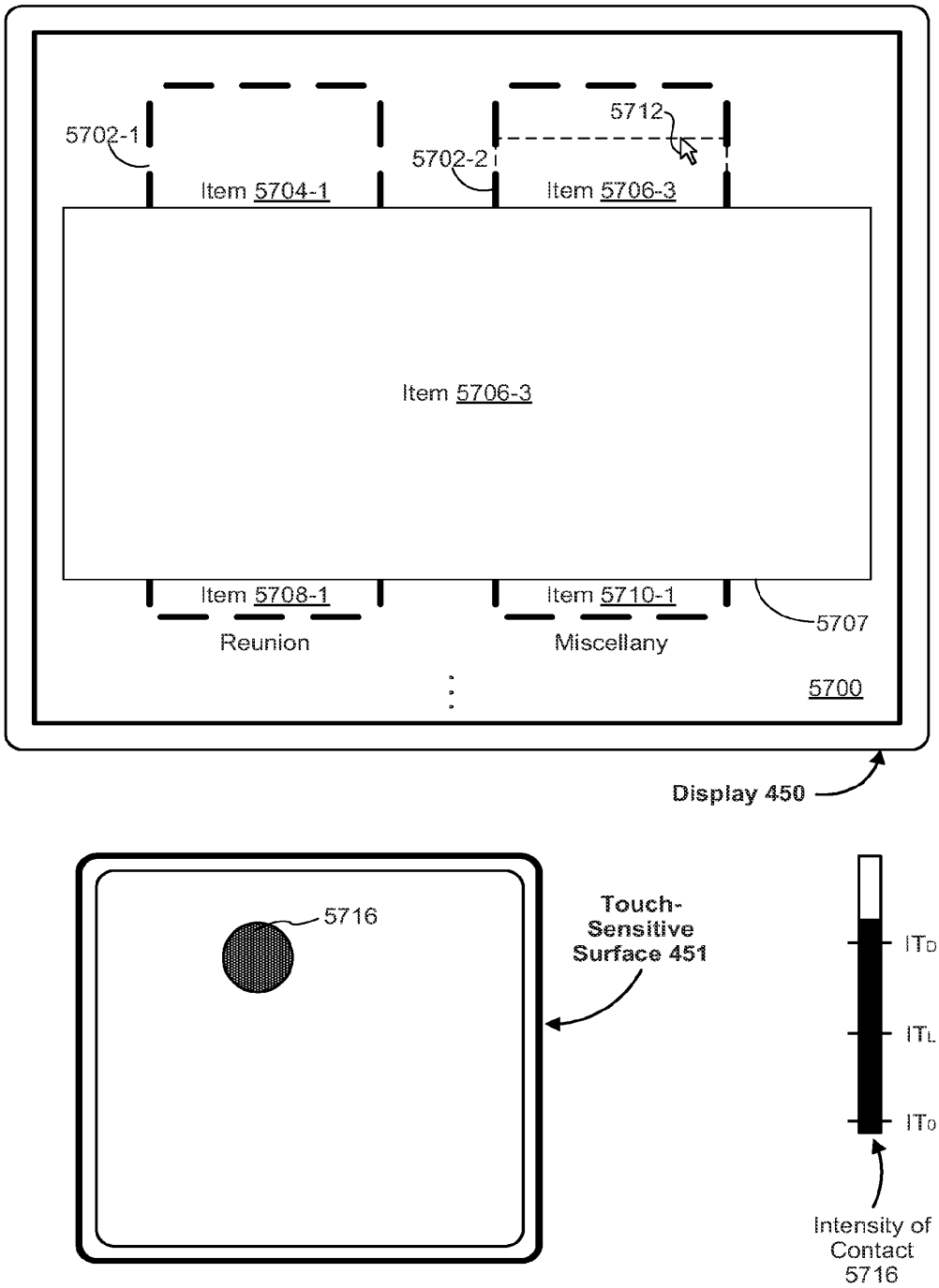

5702-1
5712
5702-2
Item 5704-1
Item 5706-3
Item 5706-3
Item 5708-1
Item 5710-1
5707
Reunion
Miscellany
5700
Display 450
5716
Touch-Sensitive Surface 451
ITD
ITL
ITD
Intensity of Contact 5716

Figure 8N

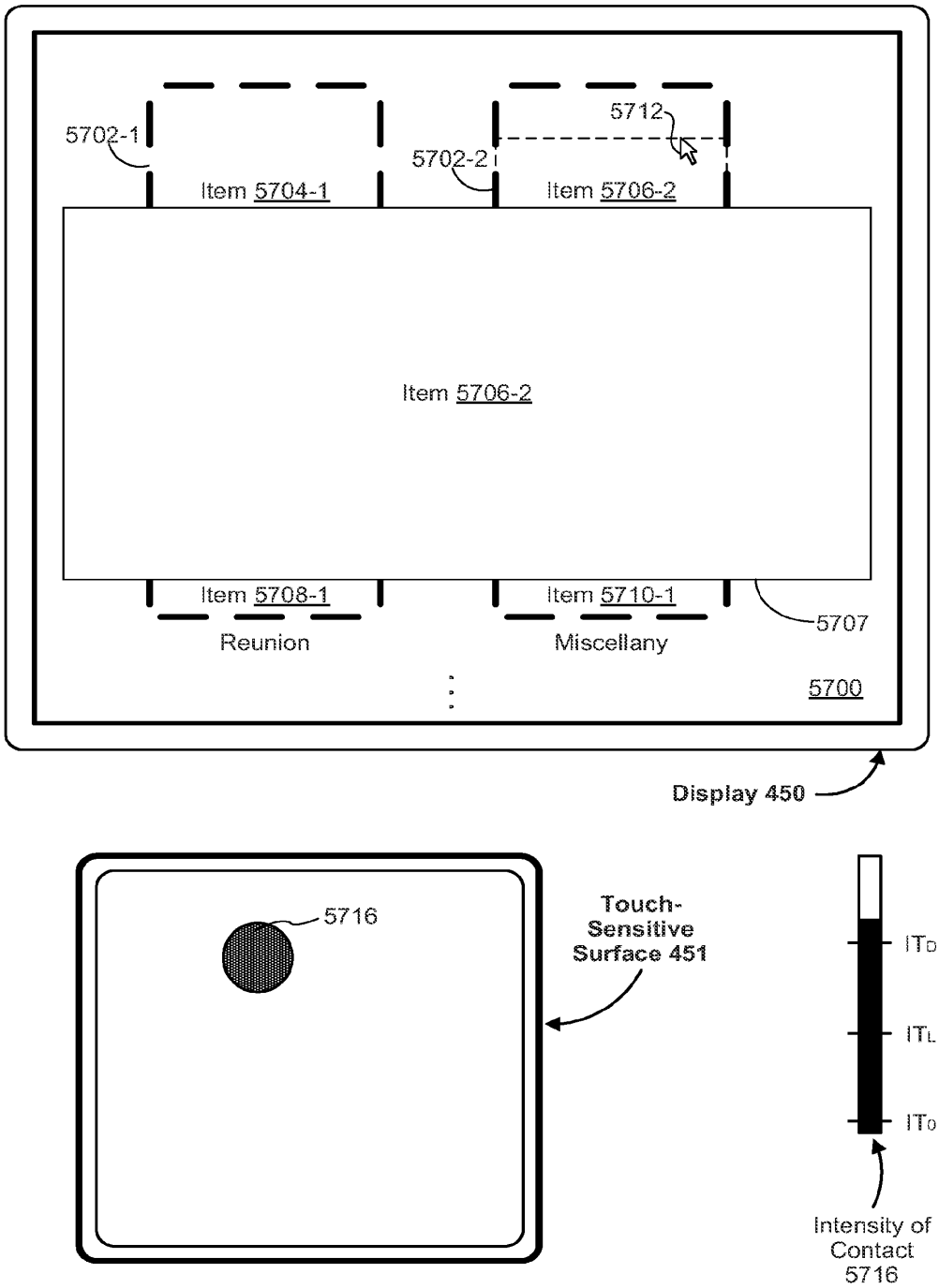

5702-1
5712
5702-2
Item 5704-1
Item 5706-2
Item 5706-2
Item 5708-1
Item 5710-1
5707
Reunion
Miscellany
5700
Display 450
5716
Touch-Sensitive Surface 451
ITD
ITL
ITO
Intensity of Contact 5716

Figure 8O

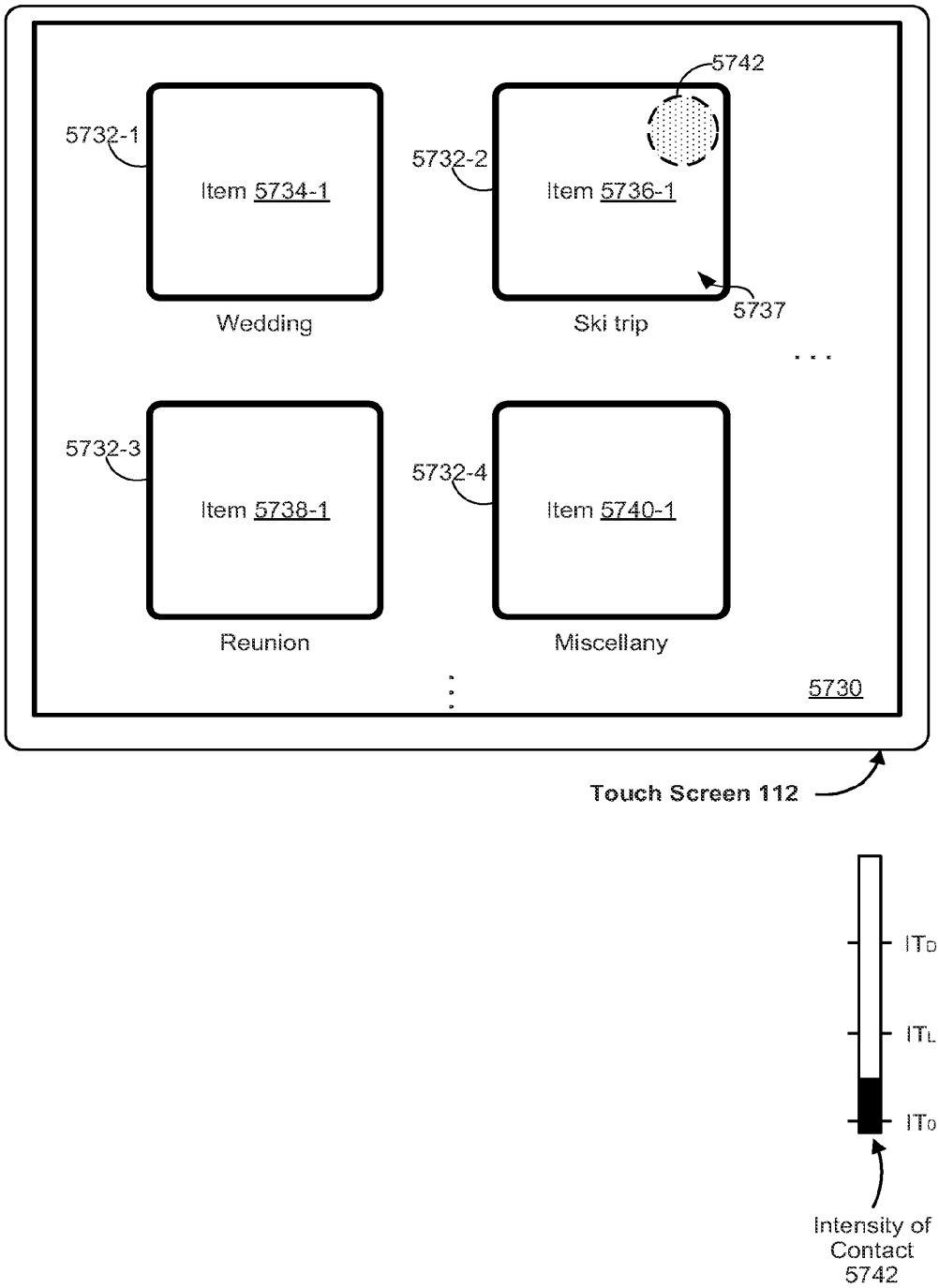

5742
5732-1
Item 5734-1
Wedding
5732-2
Item 5736-1
Ski trip
5737
5732-3
Item 5738-1
Reunion
5732-4
Item 5740-1
Miscellany
5730
Touch Screen 112
ITD
ITL
ITo
Intensity of Contact 5742

Figure 8P

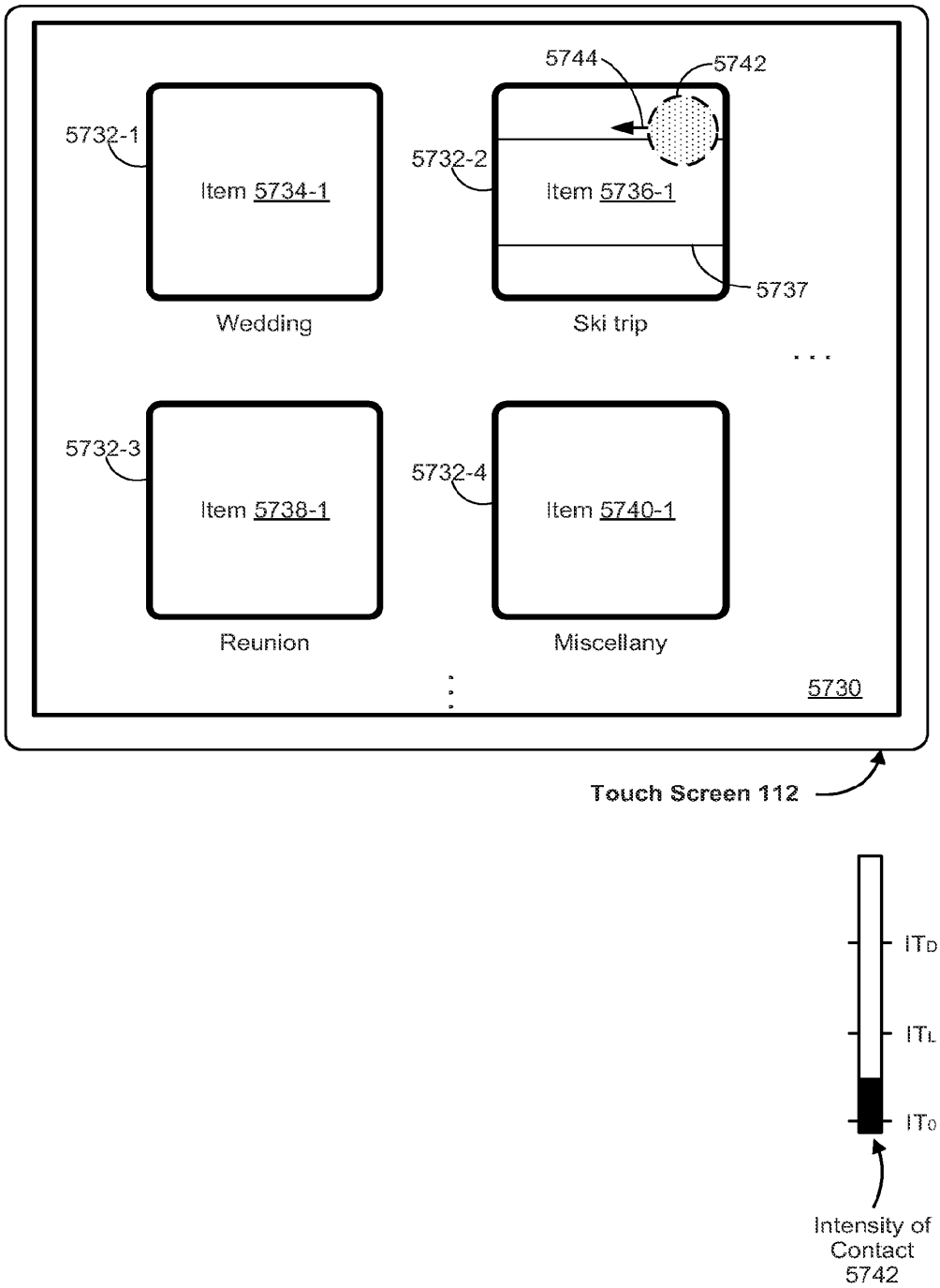

5744
5742
5732-1
Item 5734-1
5732-2
Item 5736-1
5737
Wedding
Ski trip
5732-3
Item 5738-1
5732-4
Item 5740-1
Reunion
Miscellany
5730
Touch Screen 112
ITD
ITL
ITO
Intensity of Contact 5742

Figure 8Q

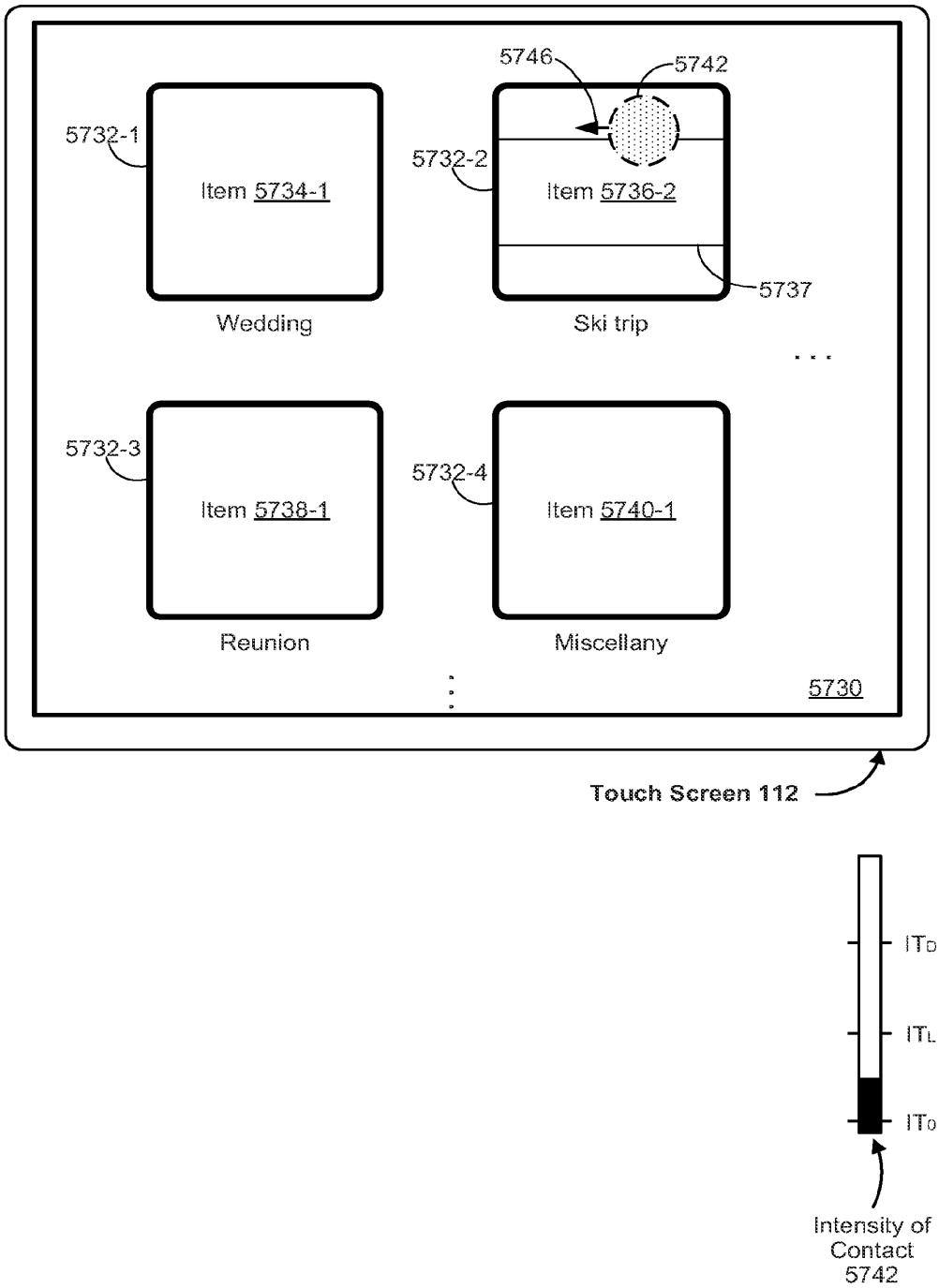

5746
5742
5732-1
Item 5734-1
5732-2
Item 5736-2
5737
Wedding
Ski trip
5732-3
Item 5738-1
5732-4
Item 5740-1
Reunion
Miscellany
5730
Touch Screen 112
ITD
ITL
ITO
Intensity of Contact 5742

Figure 8R

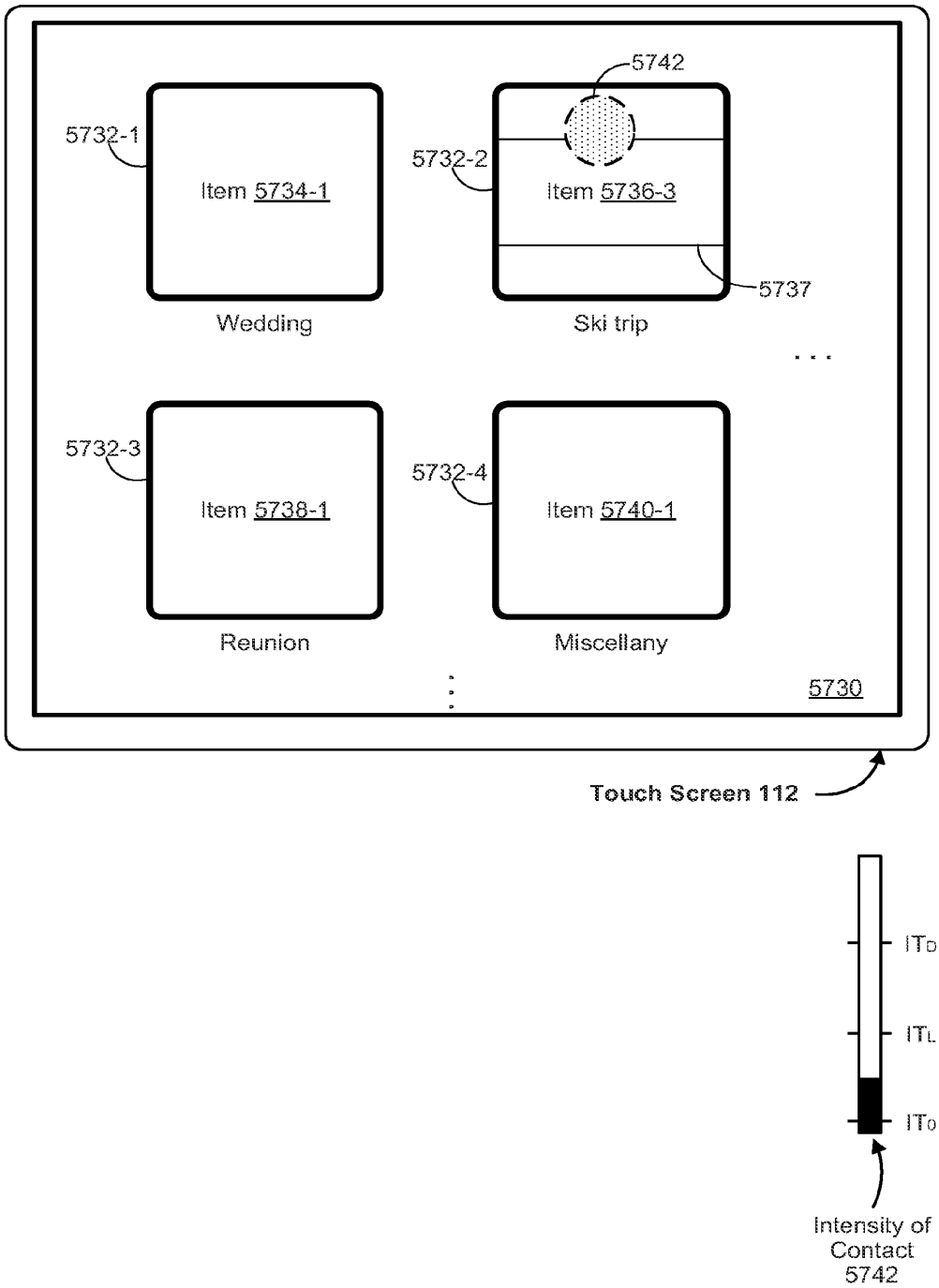

5742
5732-1
Item 5734-1
5732-2
Item 5736-3
5737
Wedding
Ski trip
5732-3
Item 5738-1
5732-4
Item 5740-1
Reunion
Miscellany
5730
Touch Screen 112
ITD
ITL
ITO
Intensity of Contact 5742

Figure 8S

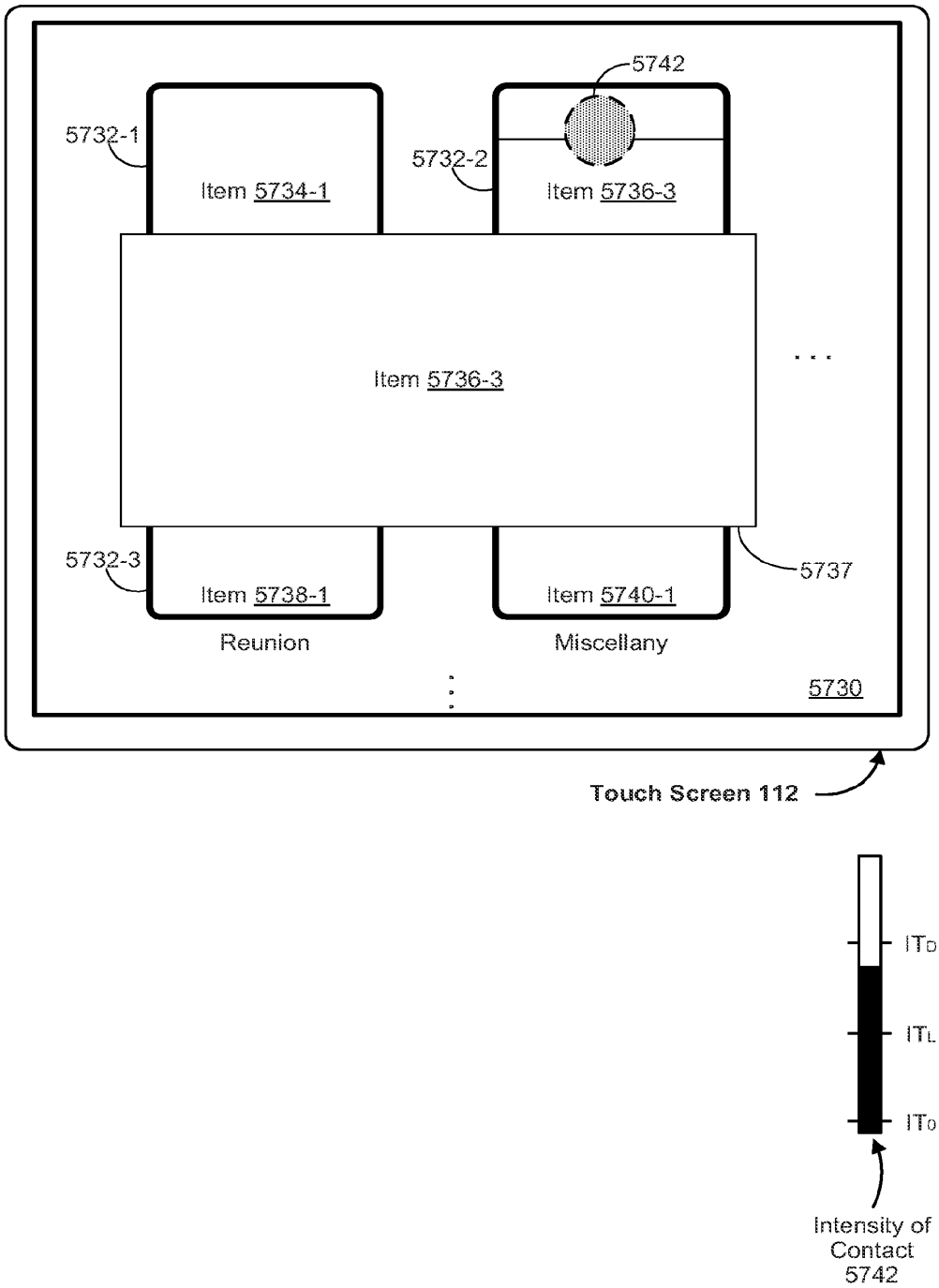

5742
5732-1
Item 5734-1
5732-2
Item 5736-3
Item 5736-3
5732-3
Item 5738-1
Item 5740-1
5737
Reunion
Miscellany
5730
Touch Screen 112
ITD
ITL
ITD
Intensity of Contact 5742

Figure 8T

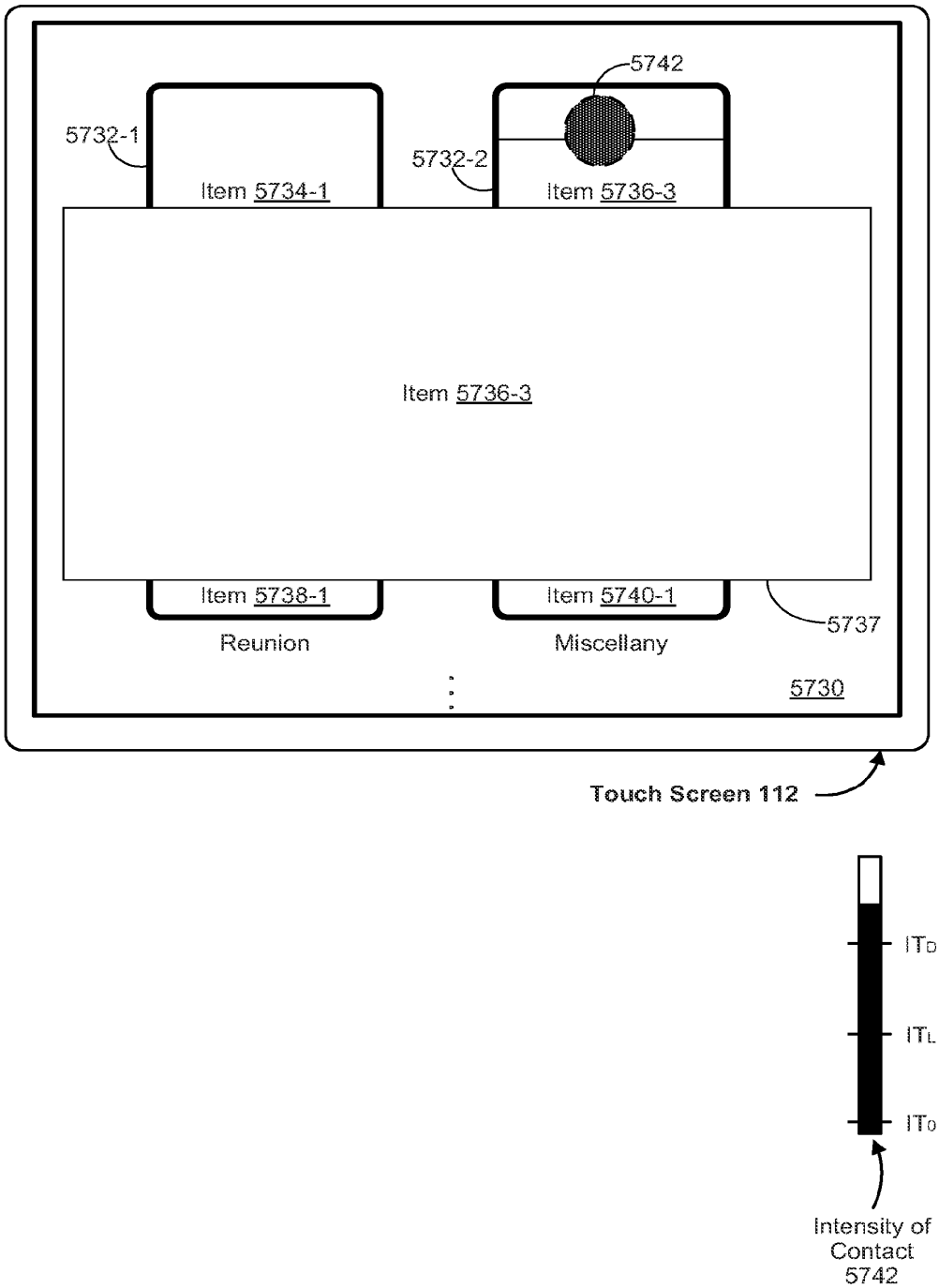

5742
5732-1
5732-2
Item 5734-1
Item 5736-3
Item 5736-3
Item 5738-1
Item 5740-1
5737
Reunion
Miscellany
5730
Touch Screen 112
ITD
ITL
ITO
Intensity of Contact 5742

Figure 8U

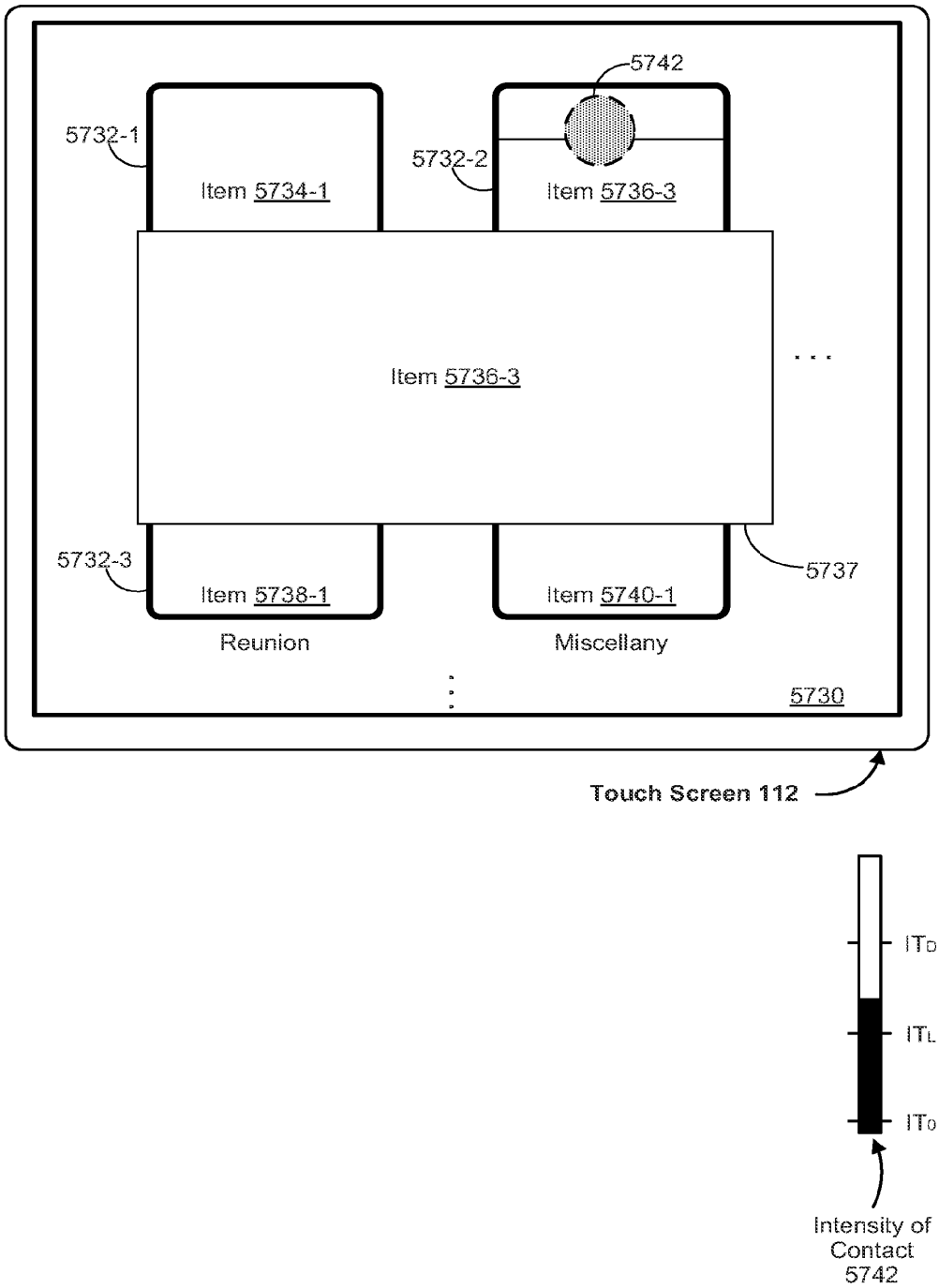

5742
5732-1
Item 5734-1
5732-2
Item 5736-3
Item 5736-3
5732-3
Item 5738-1
Item 5740-1
5737
Reunion
Miscellany
5730
Touch Screen 112
ITD
ITL
ITD
Intensity of Contact 5742

Figure 8V

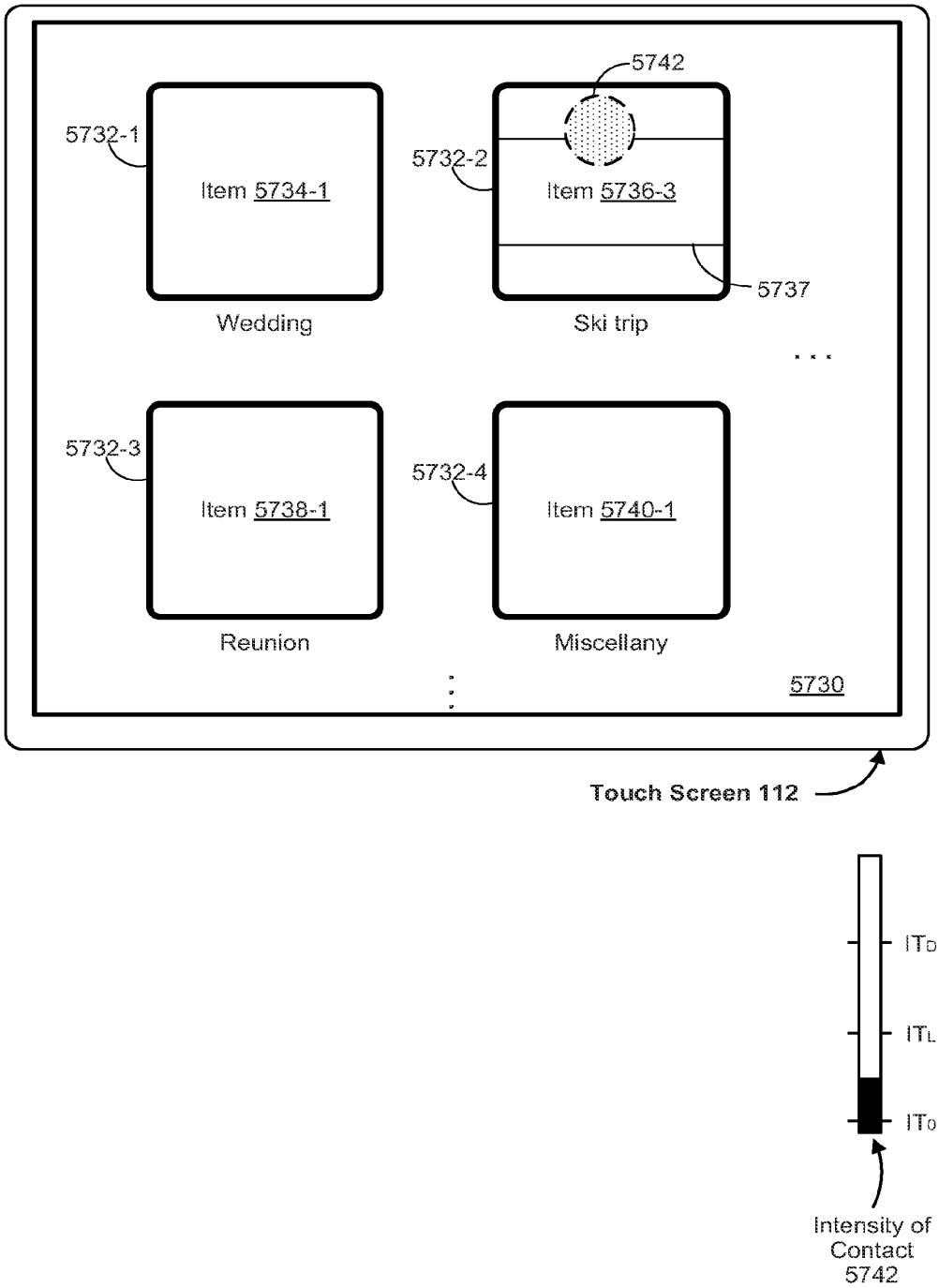

5742
5732-1
Item 5734-1
5732-2
Item 5736-3
5737
Wedding
Ski trip
5732-3
Item 5738-1
5732-4
Item 5740-1
Reunion
Miscellany
5730
Touch Screen 112
ITD
ITL
ITO
Intensity of Contact 5742

Figure 8W

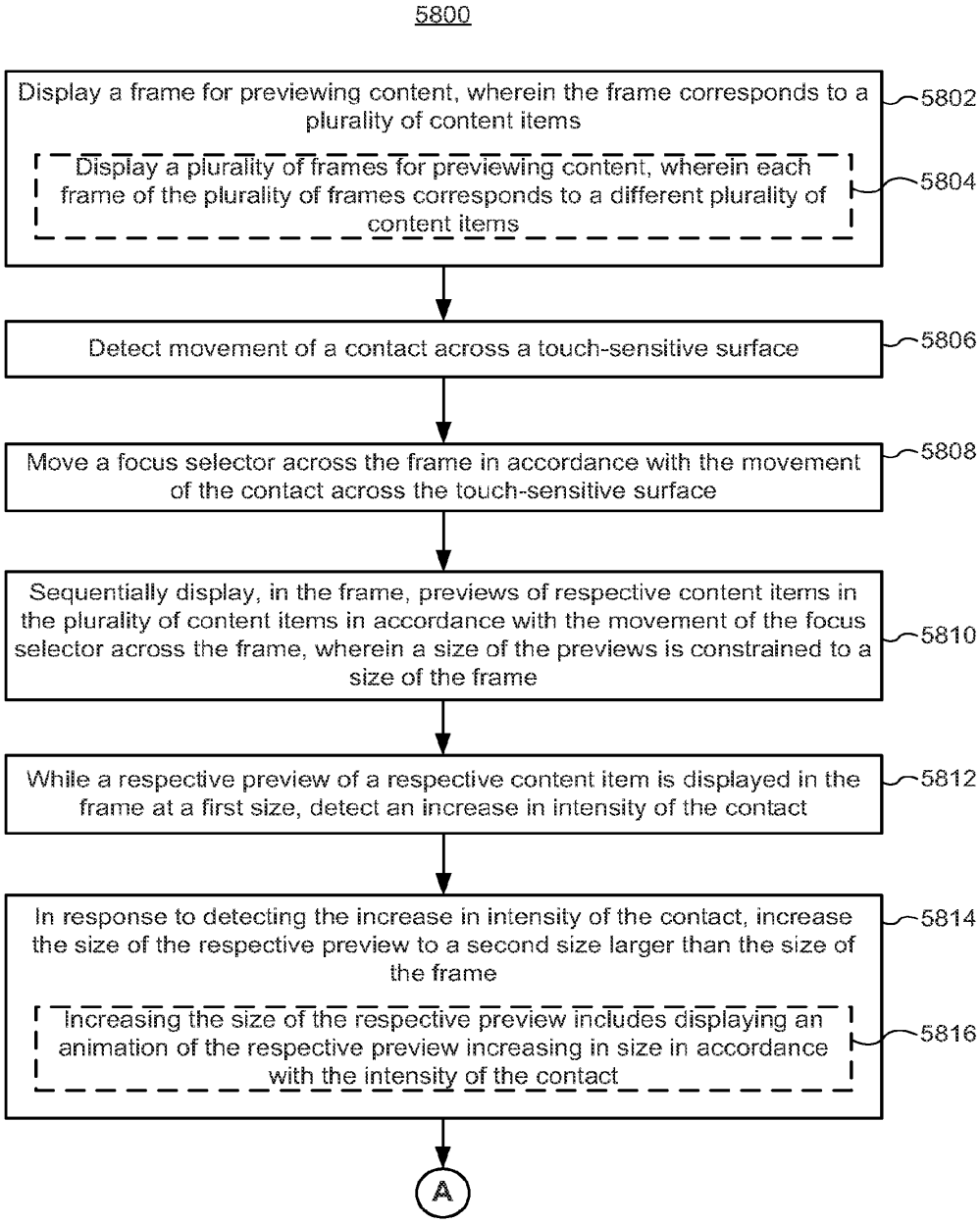

5800
Display a frame for previewing content, wherein the frame corresponds to a plurality of content items
5802
Display a plurality of frames for previewing content, wherein each frame of the plurality of frames corresponds to a different plurality of content items
5804
Detect movement of a contact across a touch-sensitive surface
5806
Move a focus selector across the frame in accordance with the movement of the contact across the touch-sensitive surface
5808
Sequentially display, in the frame, previews of respective content items in the plurality of content items in accordance with the movement of the focus selector across the frame, wherein a size of the previews is constrained to a size of the frame
5810
While a respective preview of a respective content item is displayed in the frame at a first size, detect an increase in intensity of the contact
5812
In response to detecting the increase in intensity of the contact, increase the size of the respective preview to a second size larger than the size of the frame
5814
Increasing the size of the respective preview includes displaying an animation of the respective preview increasing in size in accordance with the intensity of the contact
5816
A

Figure 9A

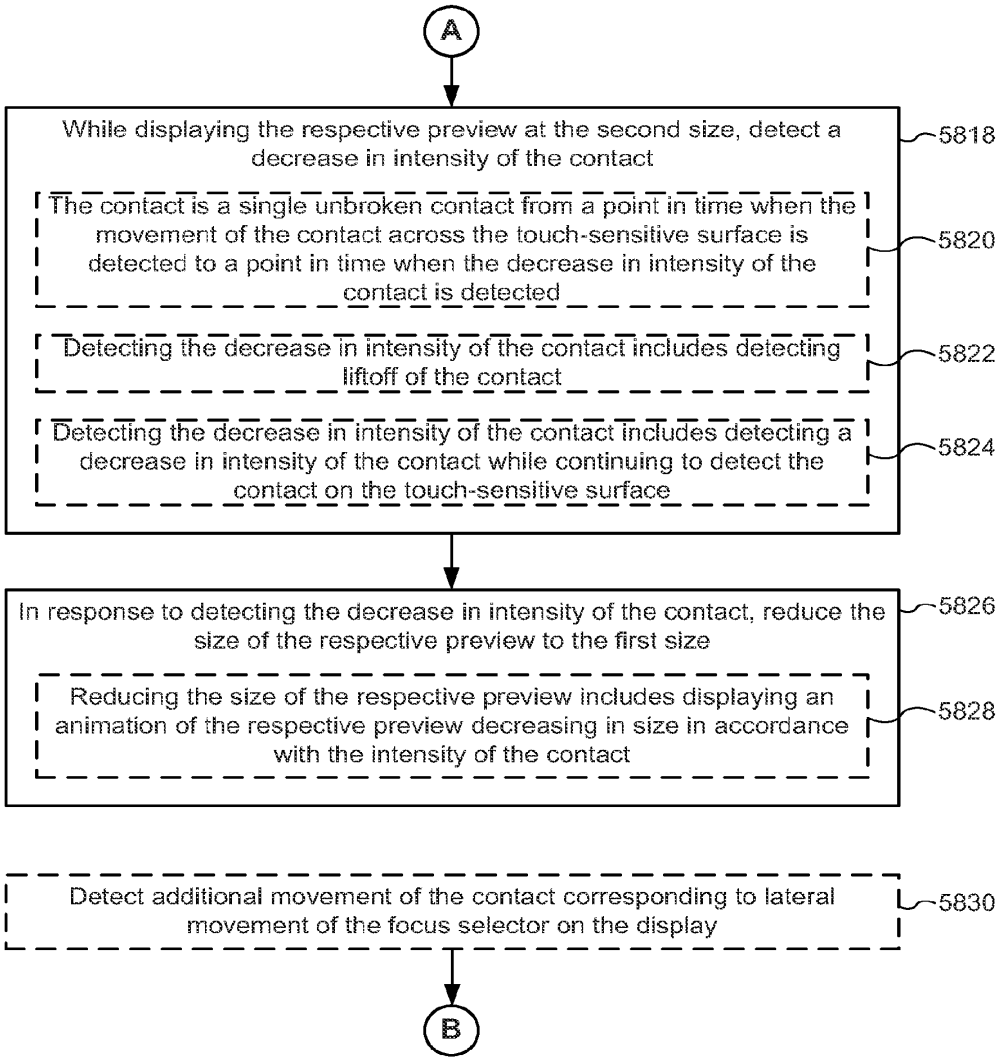

A
While displaying the respective preview at the second size, detect a decrease in intensity of the contact
5818
The contact is a single unbroken contact from a point in time when the movement of the contact across the touch-sensitive surface is detected to a point in time when the decrease in intensity of the contact is detected
5820
Detecting the decrease in intensity of the contact includes detecting liftoff of the contact
5822
Detecting the decrease in intensity of the contact includes detecting a decrease in intensity of the contact while continuing to detect the contact on the touch-sensitive surface
5824
In response to detecting the decrease in intensity of the contact, reduce the size of the respective preview to the first size
5826
Reducing the size of the respective preview includes displaying an animation of the respective preview decreasing in size in accordance with the intensity of the contact
5828
Detect additional movement of the contact corresponding to lateral movement of the focus selector on the display
5830
B

Figure 9B

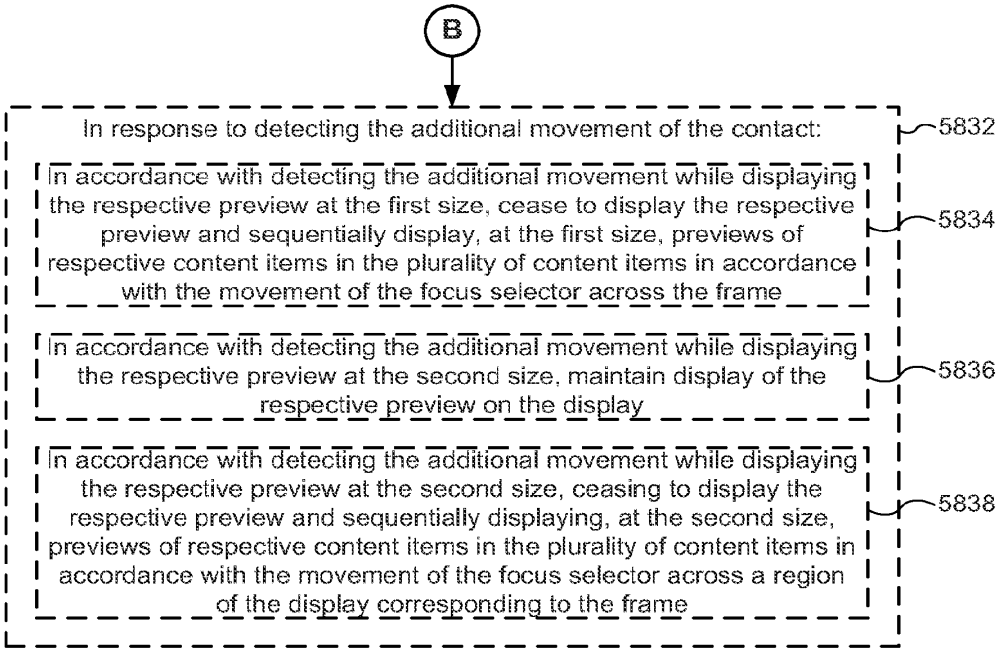

B
In response to detecting the additional movement of the contact:
5832
In accordance with detecting the additional movement while displaying the respective preview at the first size, cease to display the respective preview and sequentially display, at the first size, previews of respective content items in the plurality of content items in accordance with the movement of the focus selector across the frame
5834
In accordance with detecting the additional movement while displaying the respective preview at the second size, maintain display of the respective preview on the display
5836
In accordance with detecting the additional movement while displaying the respective preview at the second size, ceasing to display the respective preview and sequentially displaying, at the second size, previews of respective content items in the plurality of content items in accordance with the movement of the focus selector across a region of the display corresponding to the frame
5838

Figure 9C

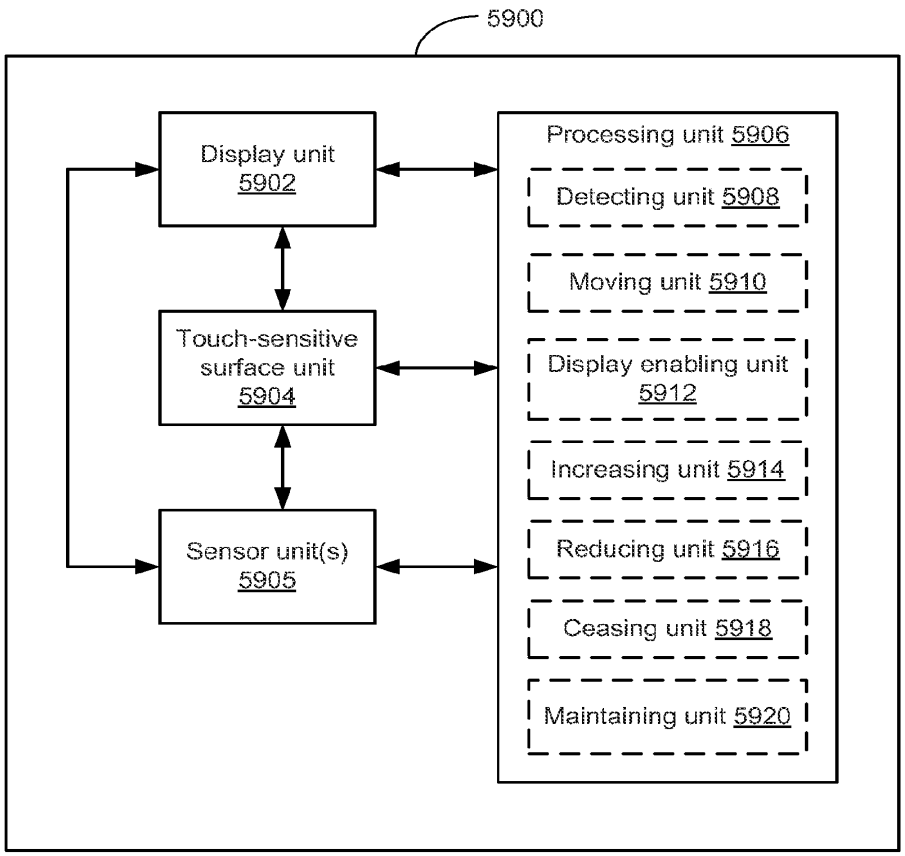

5900
Display unit 5902
Touch-sensitive surface unit 5904
Sensor unit(s) 5905
Processing unit 5906
Detecting unit 5908
Moving unit 5910
Display enabling unit 5912
Increasing unit 5914
Reducing unit 5916
Ceasing unit 5918
Maintaining unit 5920

Figure 10

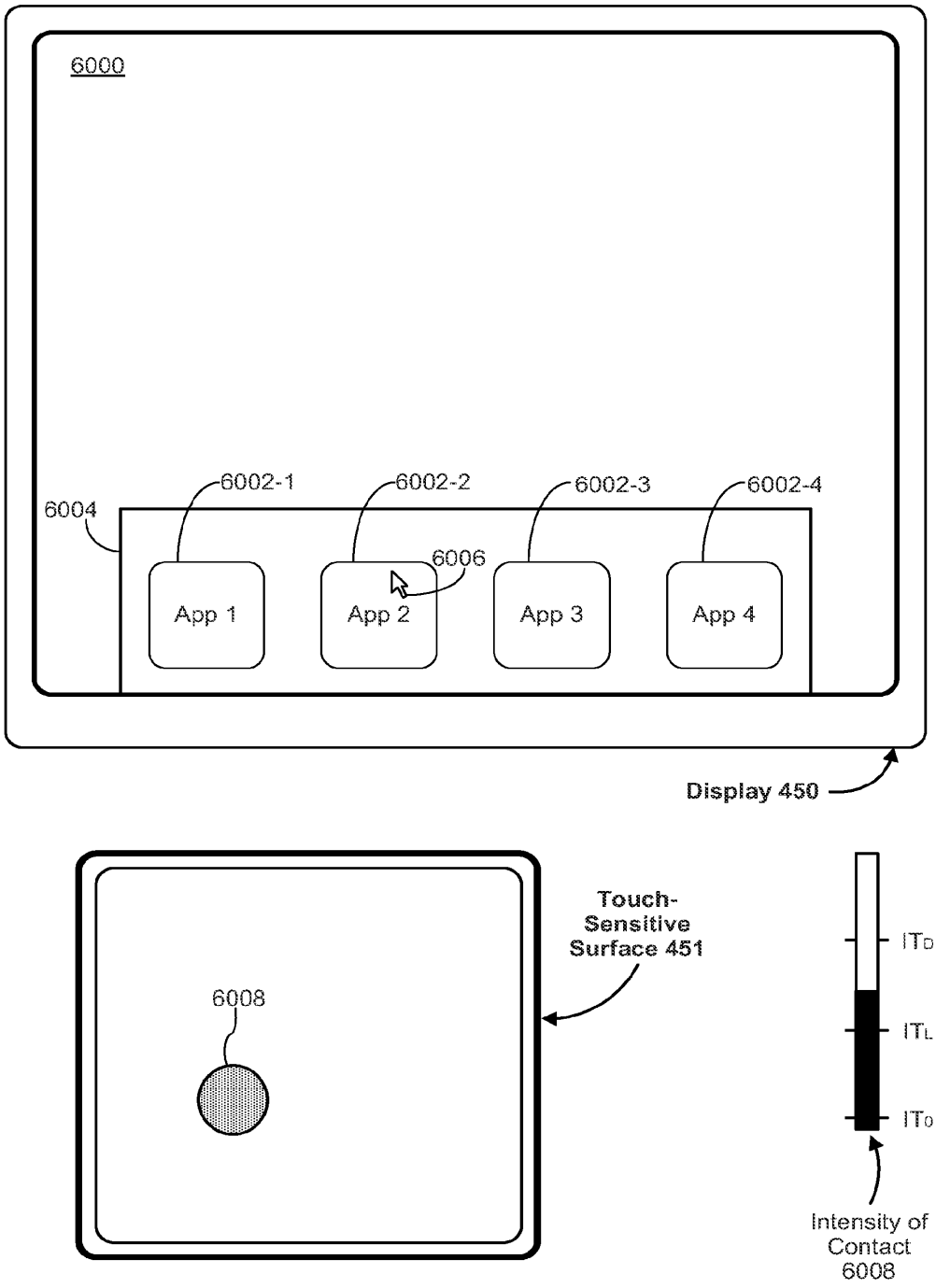
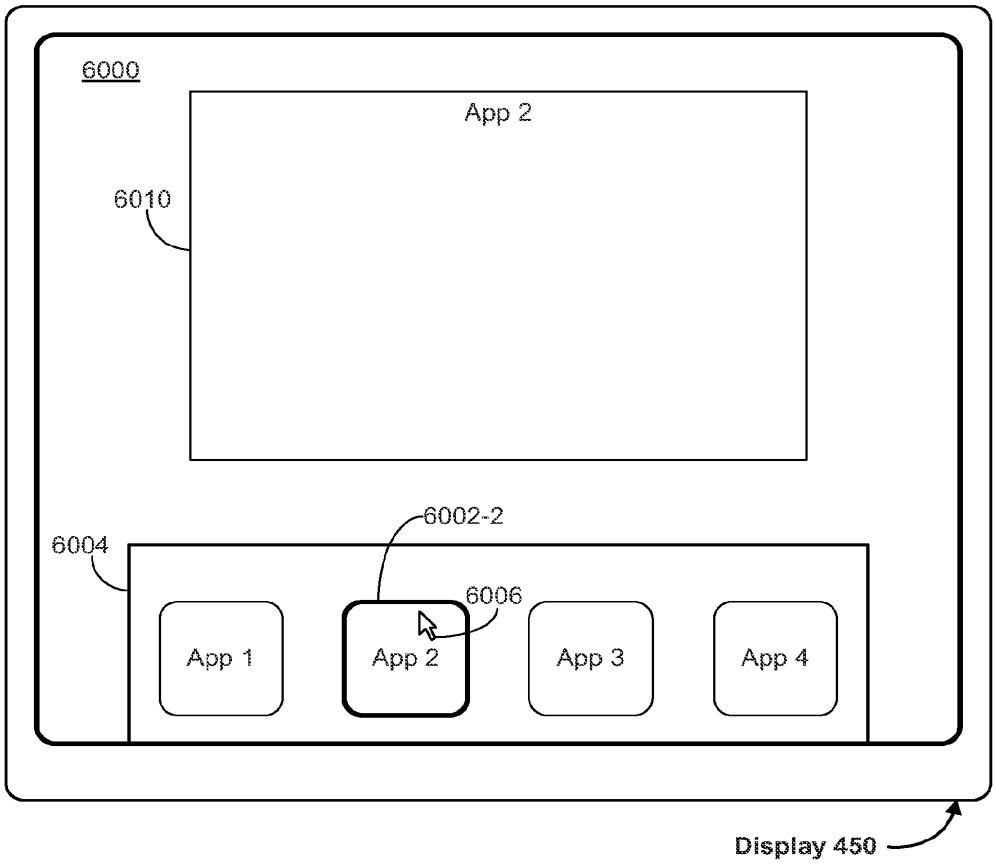

6000
6004
6002-1
6002-2
6002-3
6002-4
6006
App 1
App 2
App 3
App 4
Display 450
6008
Touch-Sensitive Surface 451
ITD
ITL
ITO
Intensity of Contact 6008

Figure 11A


6000
App 2
6010
6002-2
6004
6006
App 1
App 2
App 3
App 4
Display 450

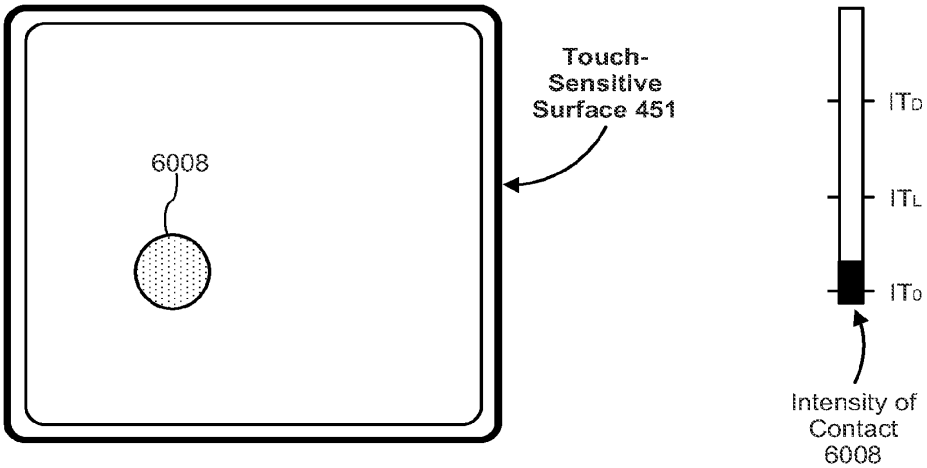

Touch-Sensitive Surface 451
6008
ITD
ITL
ITD
Intensity of Contact 6008

Figure 11B

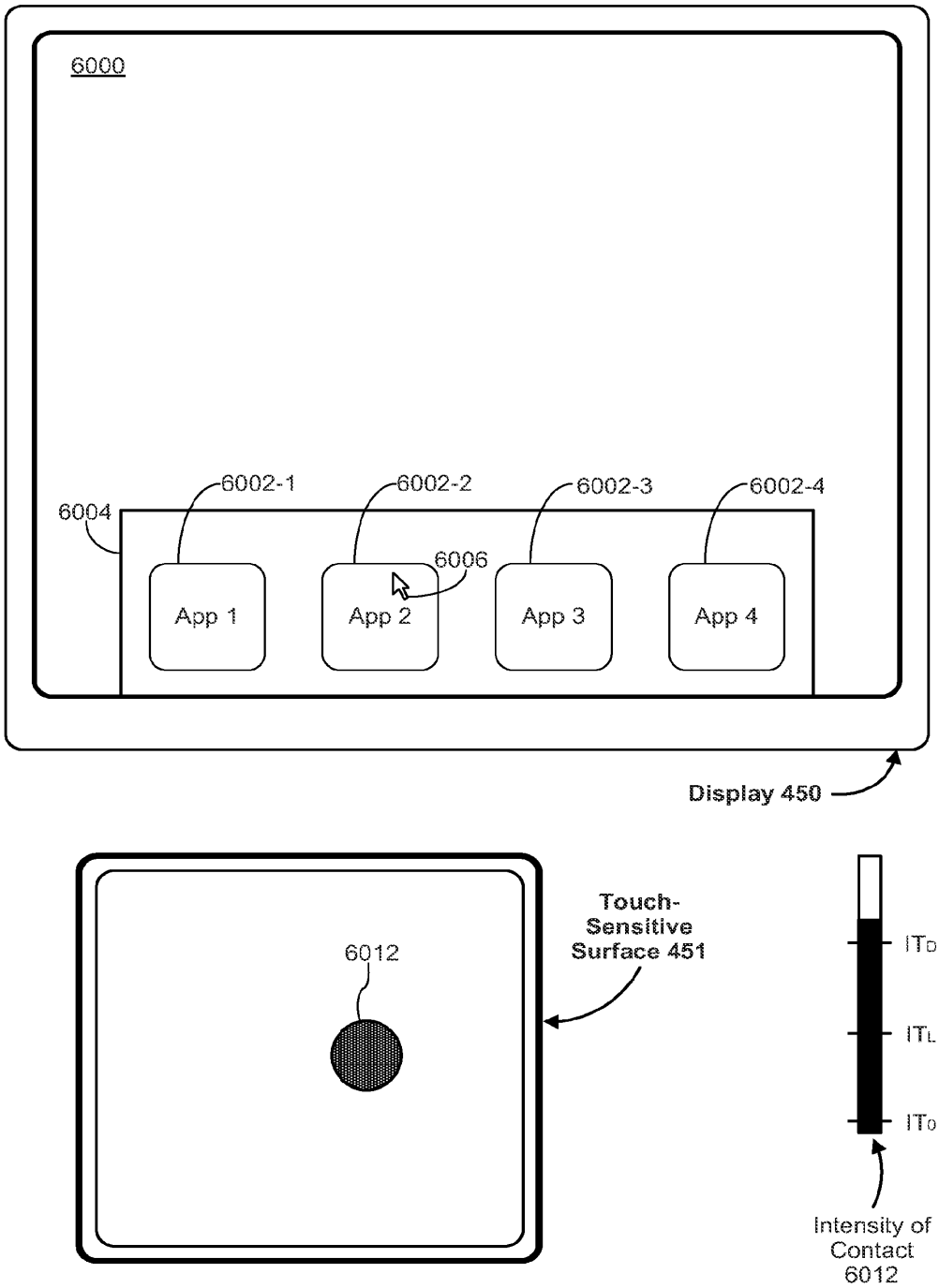

6000
6004
6002-1
6002-2
6002-3
6002-4
6006
App 1
App 2
App 3
App 4
Display 450
6012
Touch-Sensitive Surface 451
ITD
ITL
ITO
Intensity of Contact 6012

Figure 11C

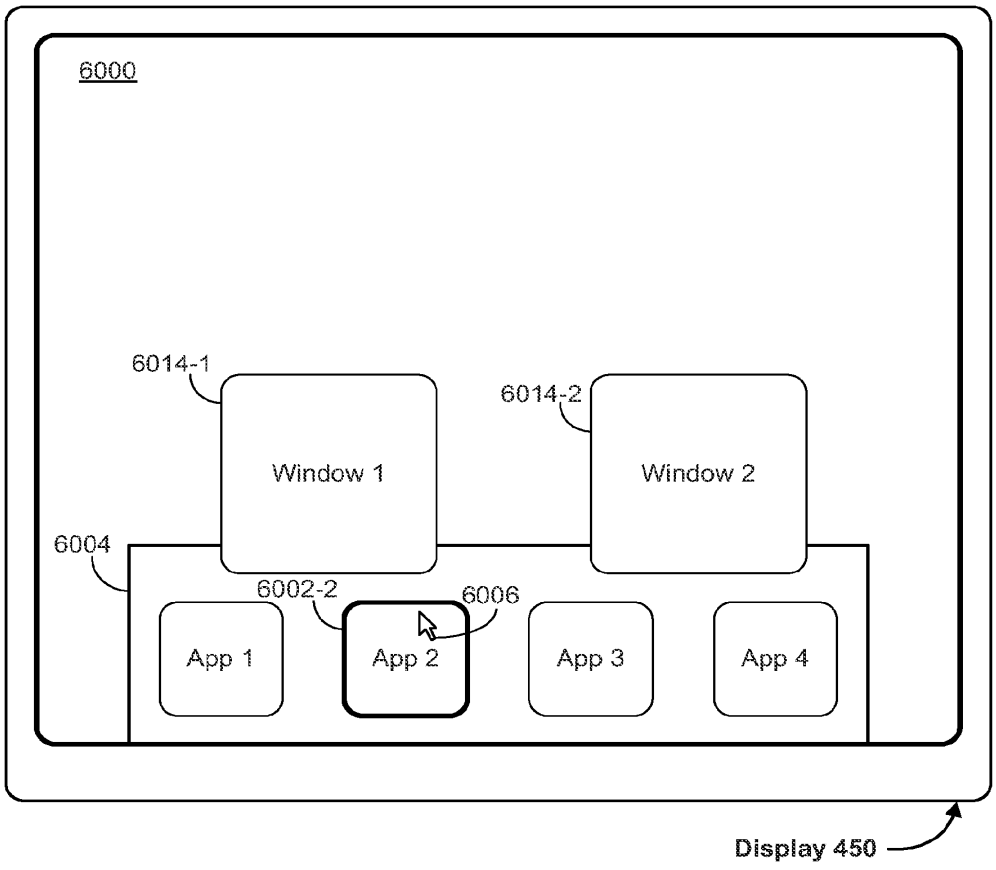

6000
6014-1
Window 1
6014-2
Window 2
6004
6002-2
6006
App 1
App 2
App 3
App 4
Display 450
6012
Touch-Sensitive Surface 451
ITD
ITL
IT0
Intensity of Contact 6012

Figure 11D

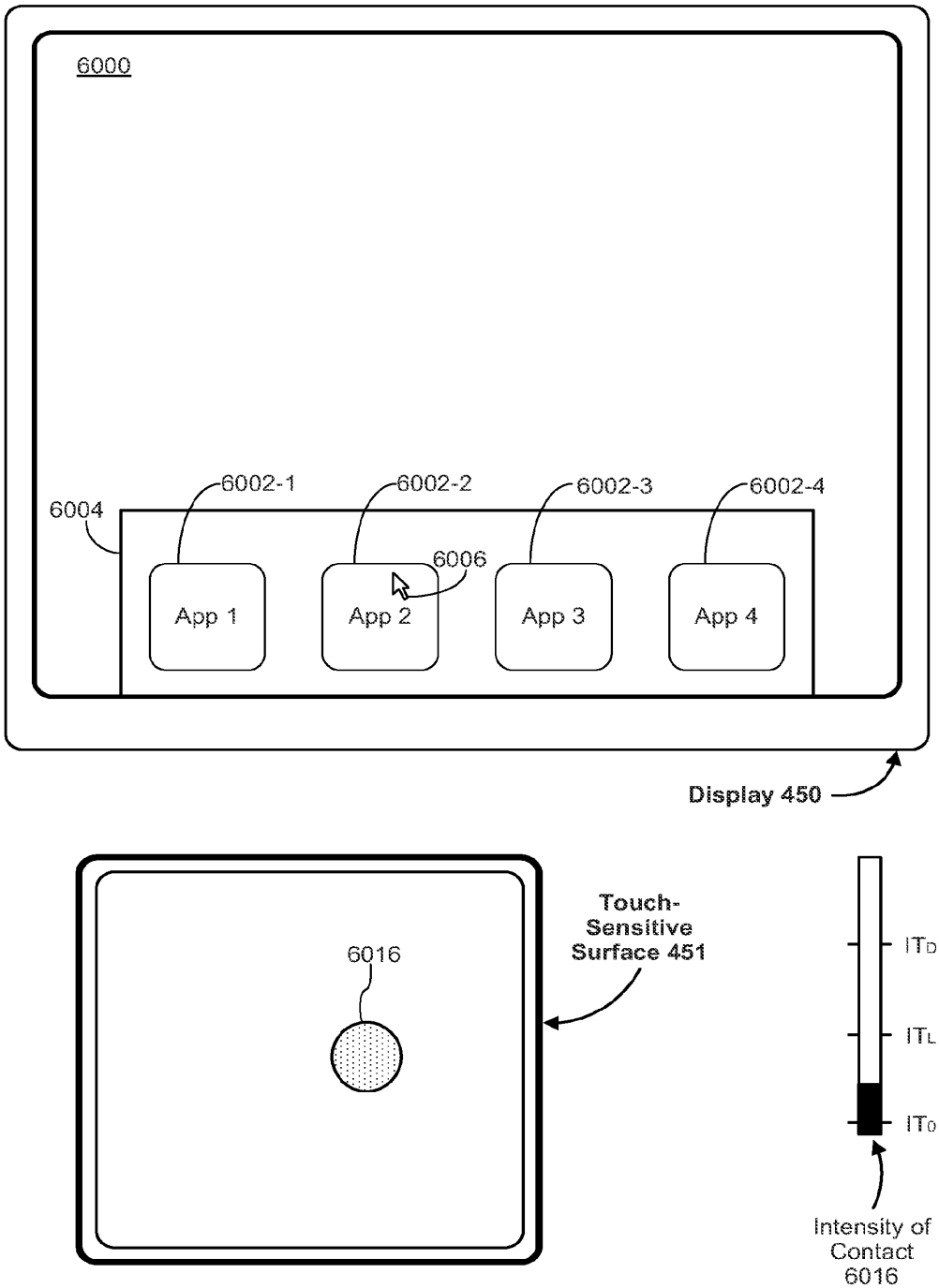

6000
6004
6002-1
6002-2
6002-3
6002-4
6006
App 1
App 2
App 3
App 4
Display 450
6016
Touch-Sensitive Surface 451
ITD
ITL
IT0
Intensity of Contact 6016

Figure 11E

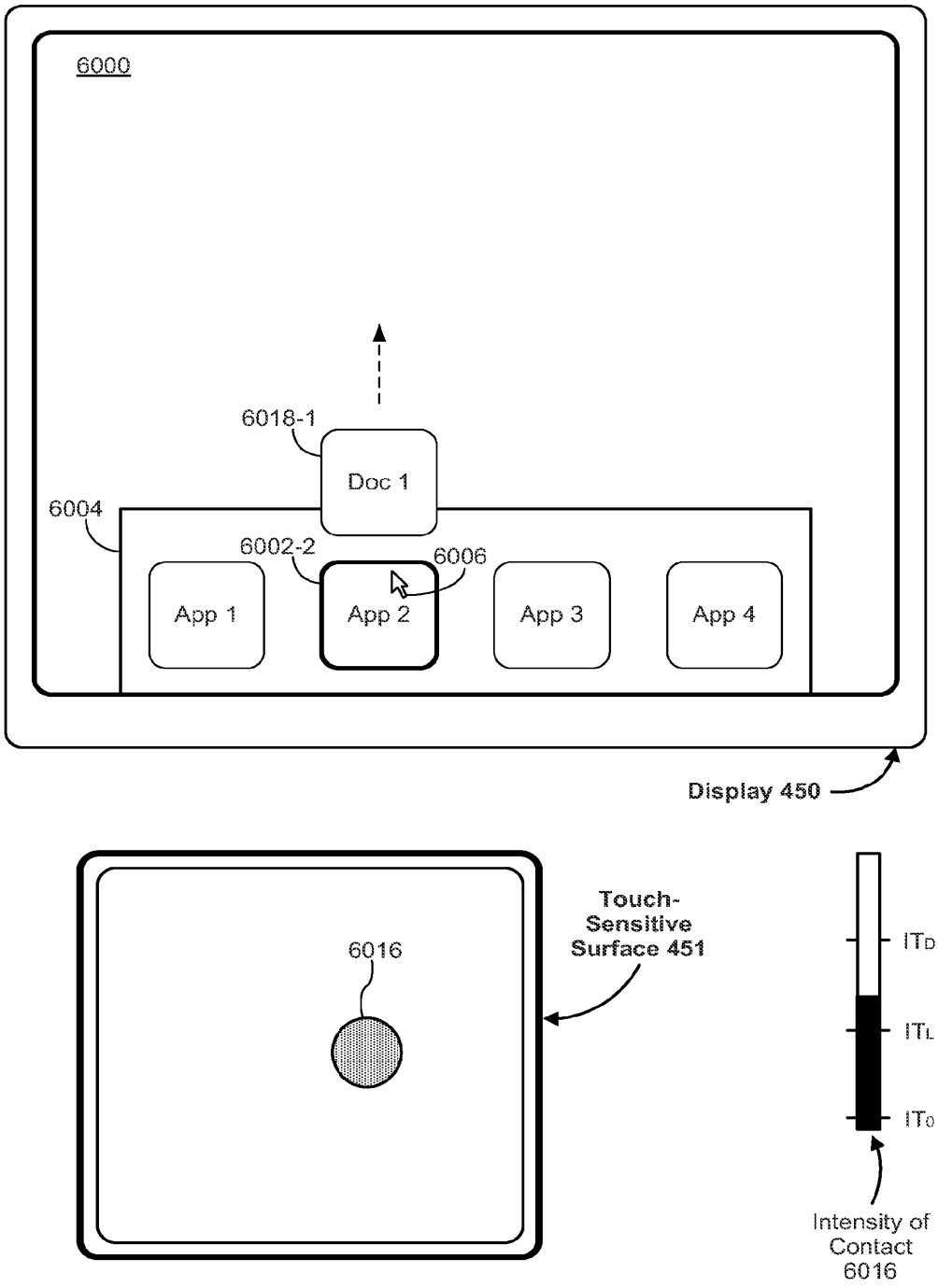

6000
6018-1
Doc 1
6004
6002-2
6006
App 1
App 2
App 3
App 4
Display 450
6016
Touch-Sensitive Surface 451
ITD
ITL
IT0
Intensity of Contact 6016

Figure 11F

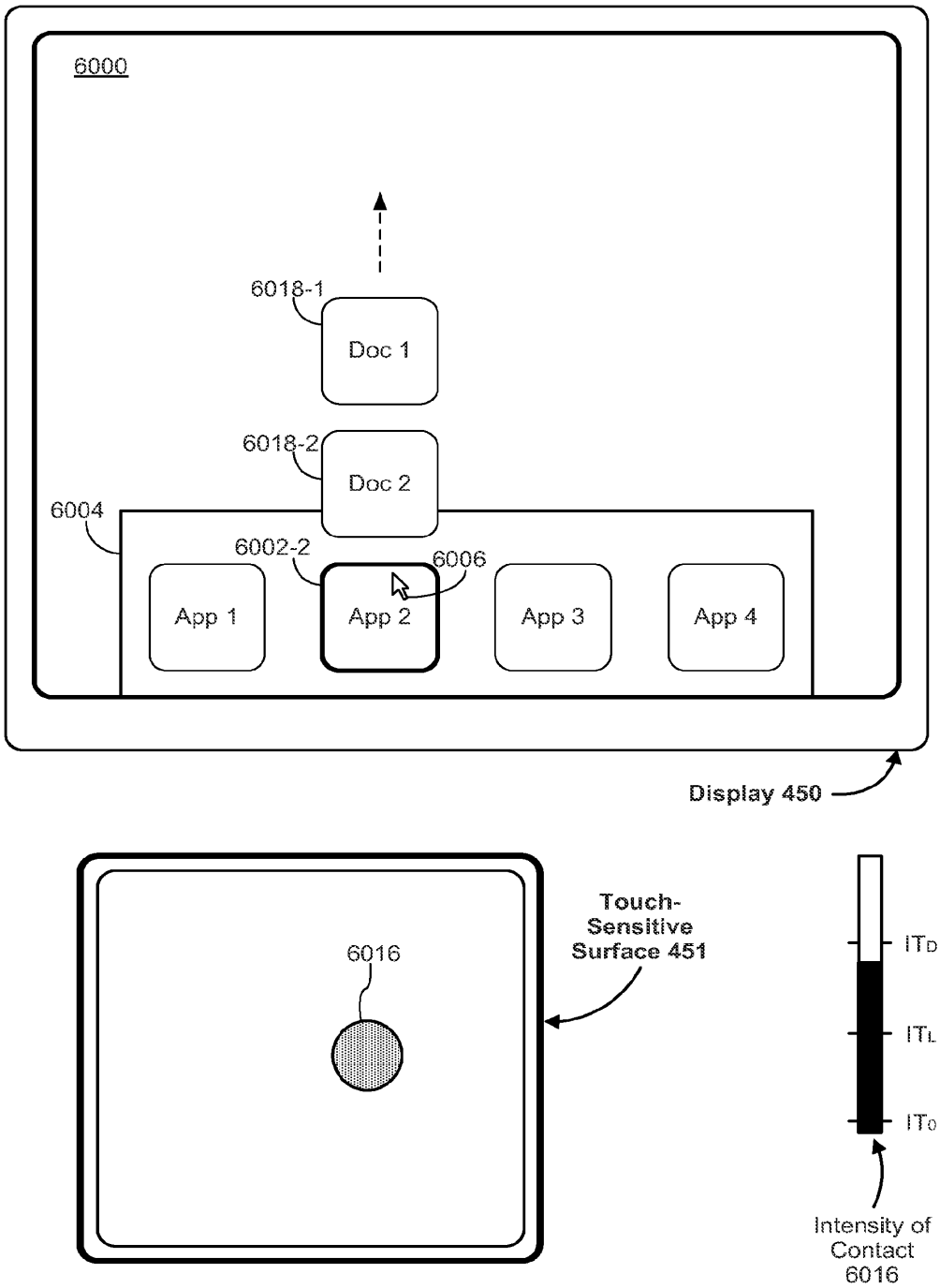

6000
6018-1
Doc 1
6018-2
Doc 2
6004
6002-2
6006
App 1
App 2
App 3
App 4
Display 450
6016
Touch-Sensitive Surface 451
ITD
ITL
IT0
Intensity of Contact 6016

Figure 11G

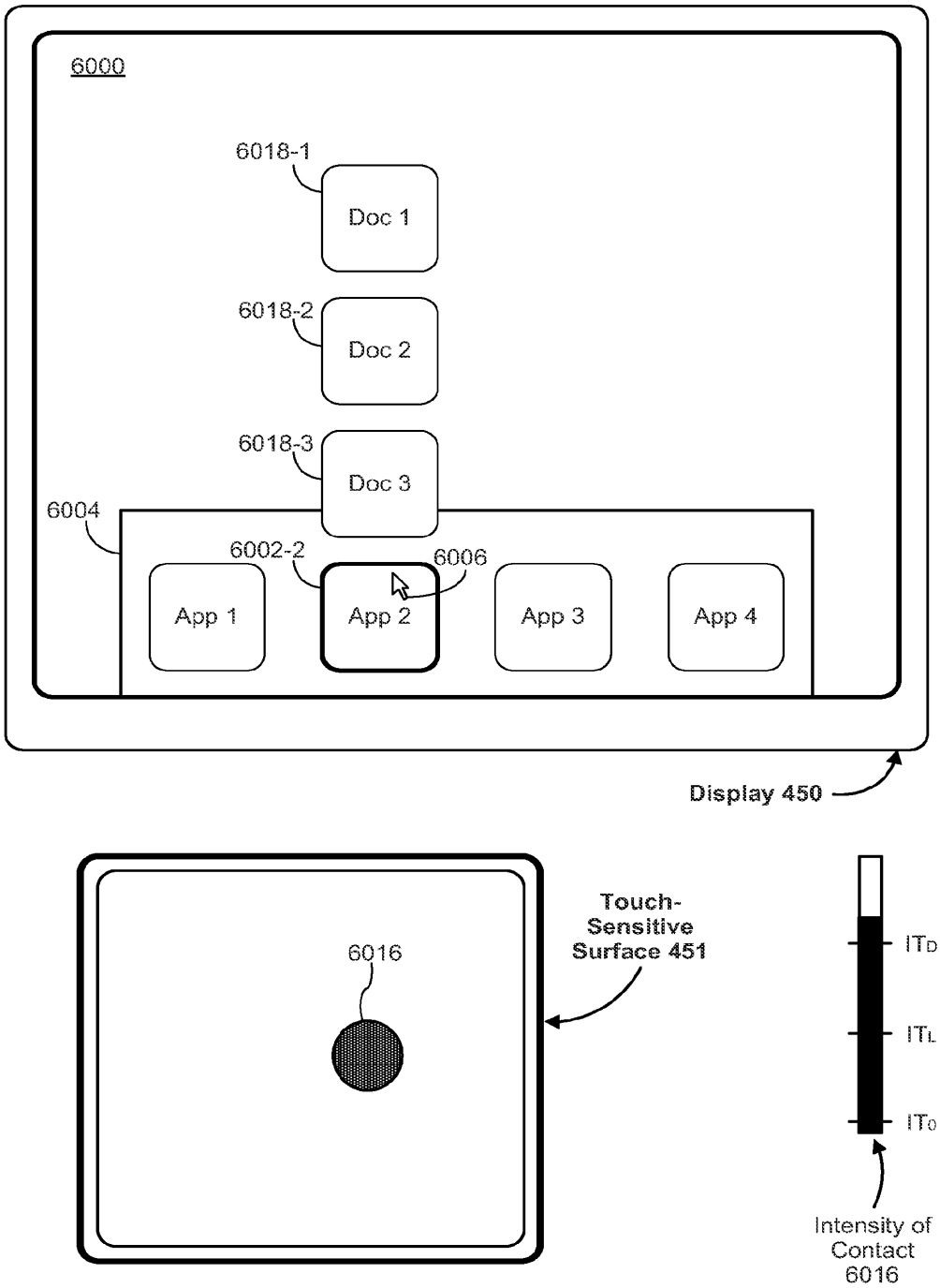

6000
6018-1
Doc 1
6018-2
Doc 2
6018-3
Doc 3
6004
6002-2
6006
App 1
App 2
App 3
App 4
Display 450
6016
Touch-Sensitive Surface 451
ITD
ITL
ITO
Intensity of Contact 6016

Figure 11H

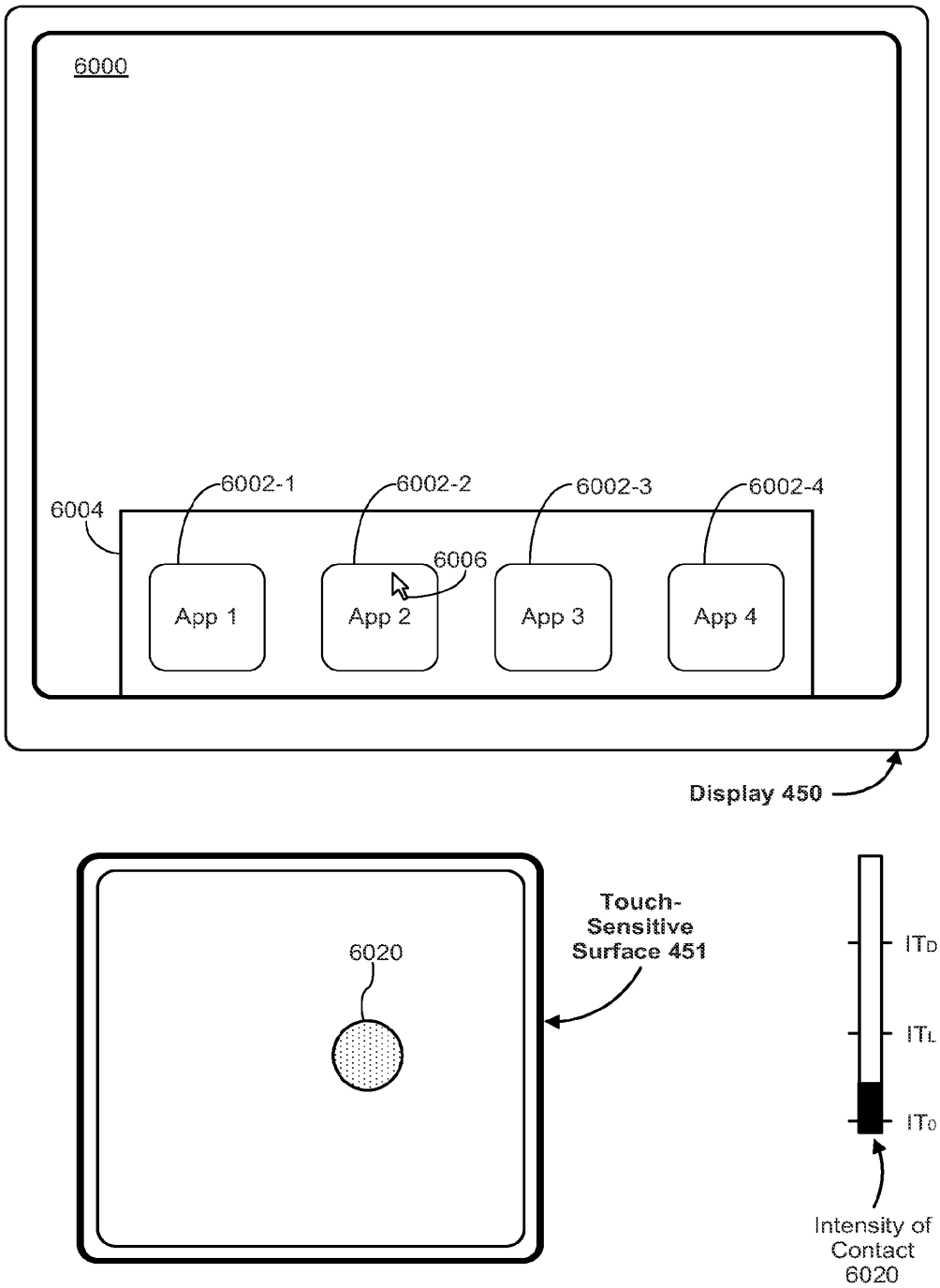
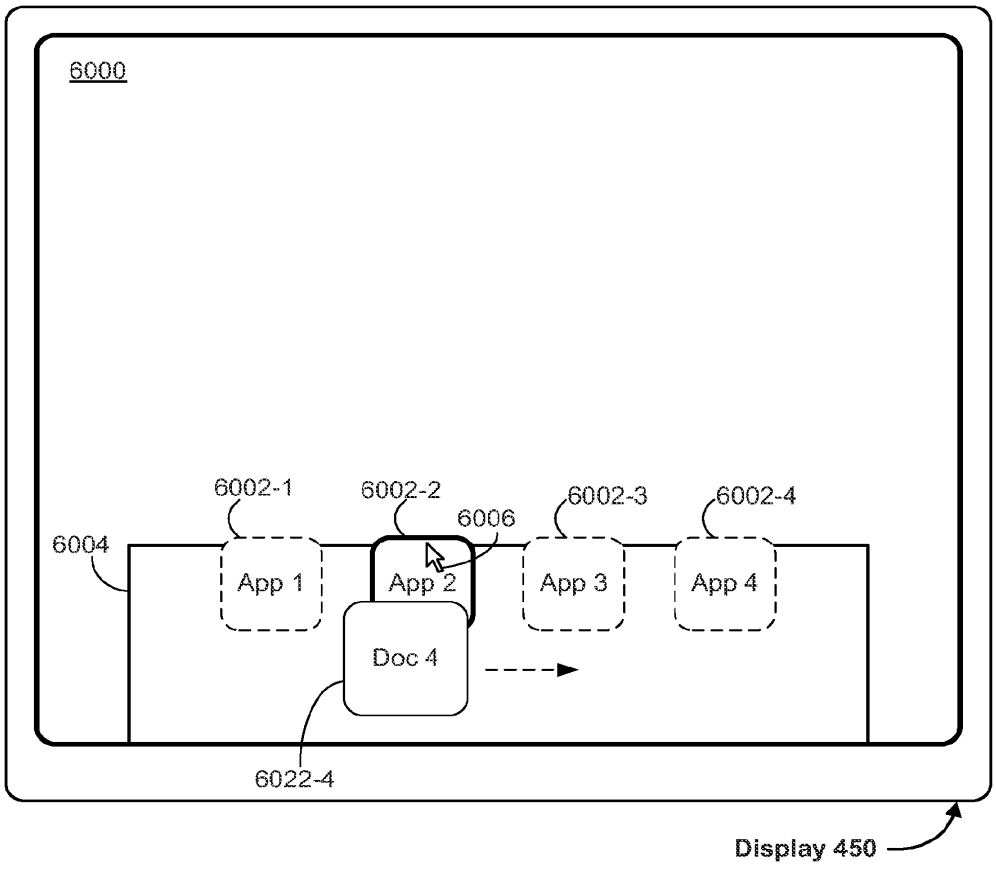

6000
6004
6002-1
6002-2
6002-3
6002-4
6006
App 1
App 2
App 3
App 4
Display 450
6020
Touch-Sensitive Surface 451
ITD
ITL
IT0
Intensity of Contact 6020

Figure 11I


6000
6002-1
6002-2
6002-3
6002-4
6006
6004
App 1
App 2
App 3
App 4
Doc 4
6022-4
Display 450

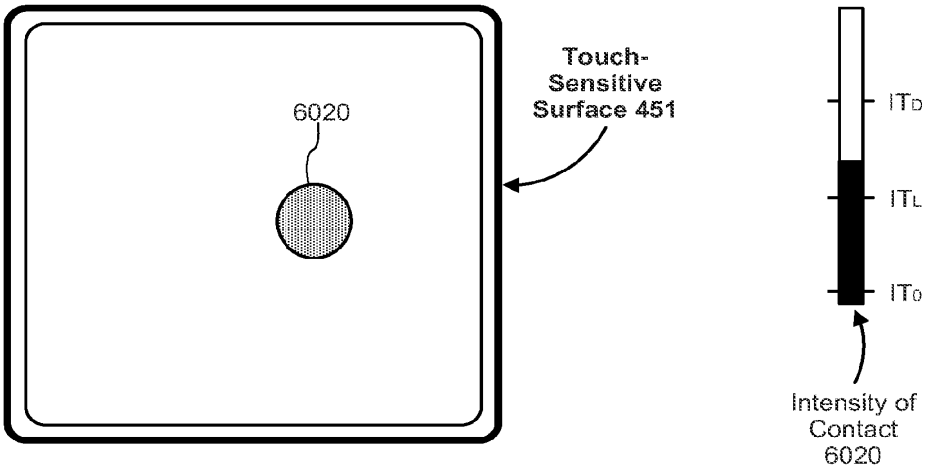

6020
Touch-Sensitive Surface 451
ITD
ITL
ITO
Intensity of Contact 6020

Figure 11J

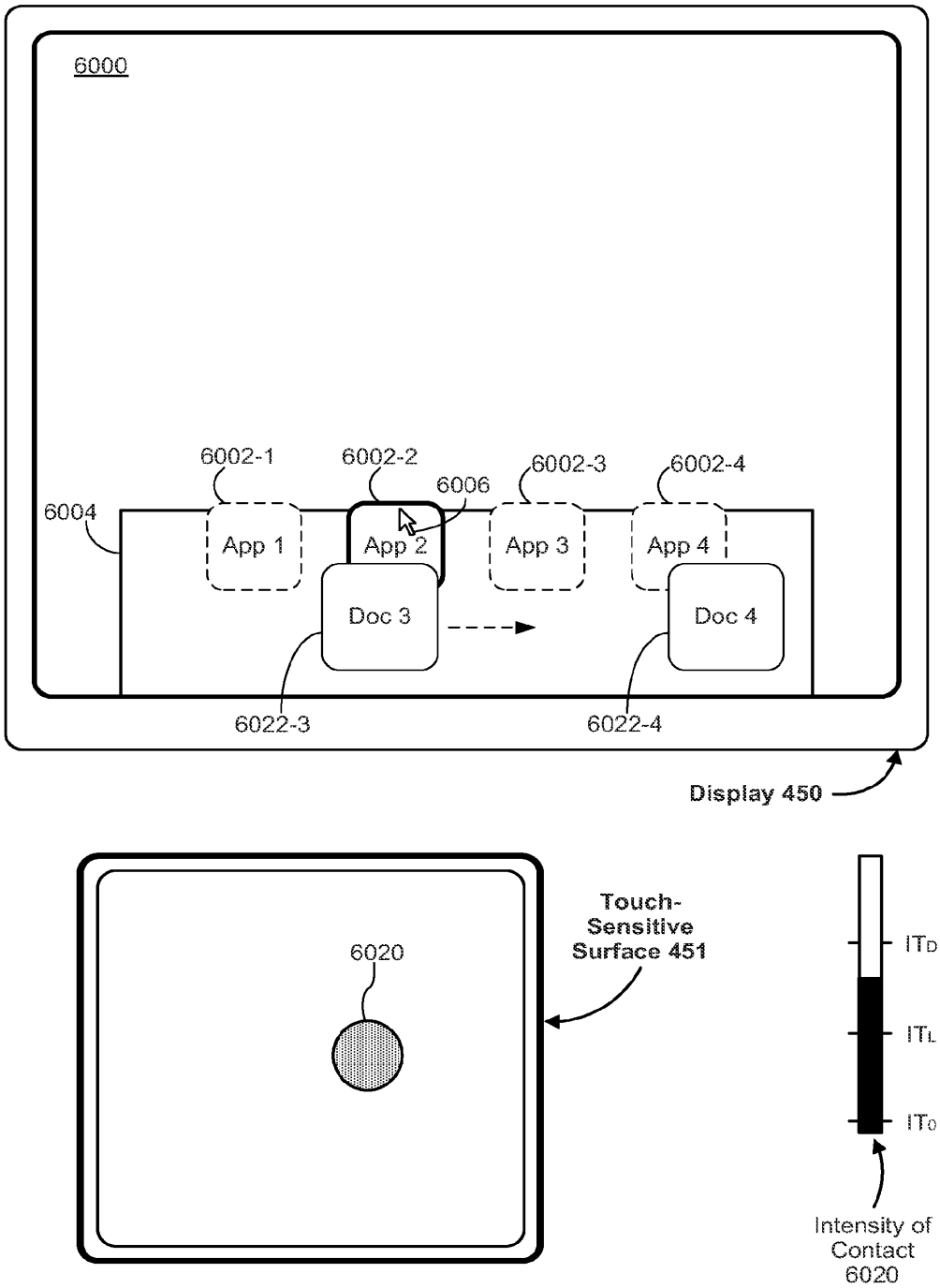
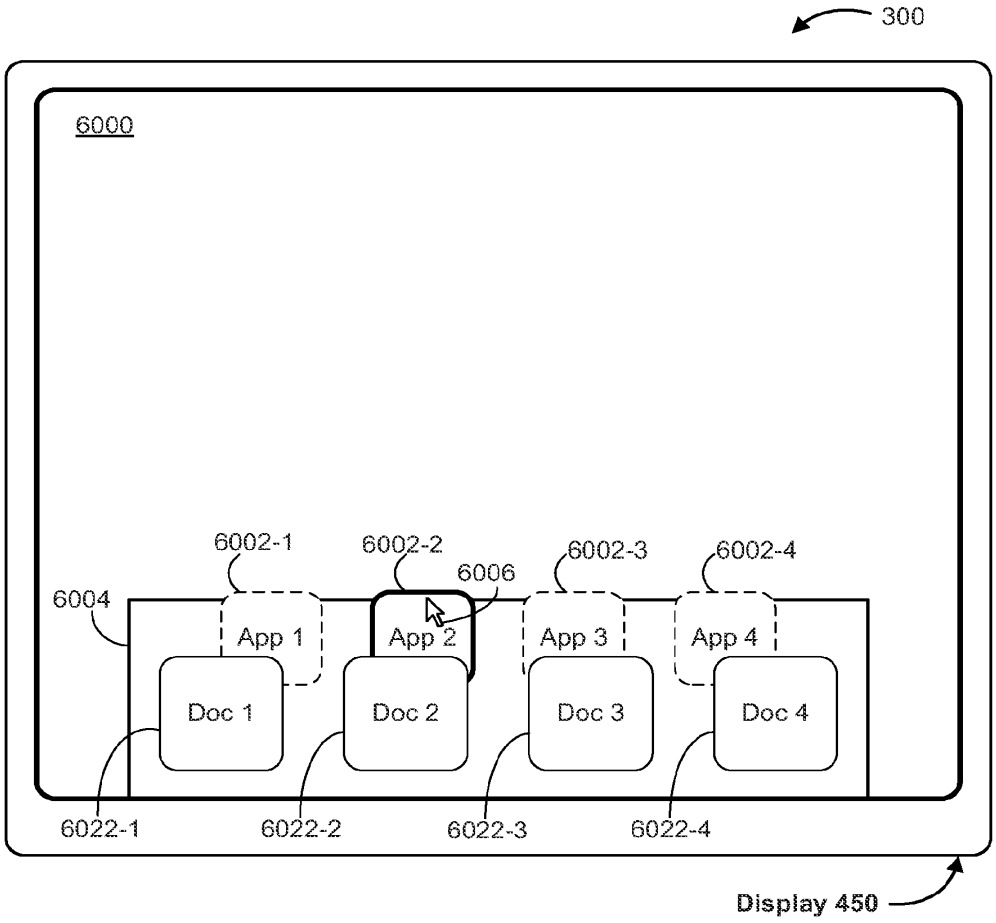

6000
6002-1
6002-2
6002-3
6002-4
6006
6004
App 1
App 2
App 3
App 4
Doc 3
Doc 4
6022-3
6022-4
Display 450
6020
Touch-Sensitive Surface 451
ITD
ITL
ITO
Intensity of Contact 6020

Figure 11K


300
6000
6002-1
6002-2
6002-3
6002-4
6006
6004
App 1
App 2
App 3
App 4
Doc 1
Doc 2
Doc 3
Doc 4
6022-1
6022-2
6022-3
6022-4
Display 450

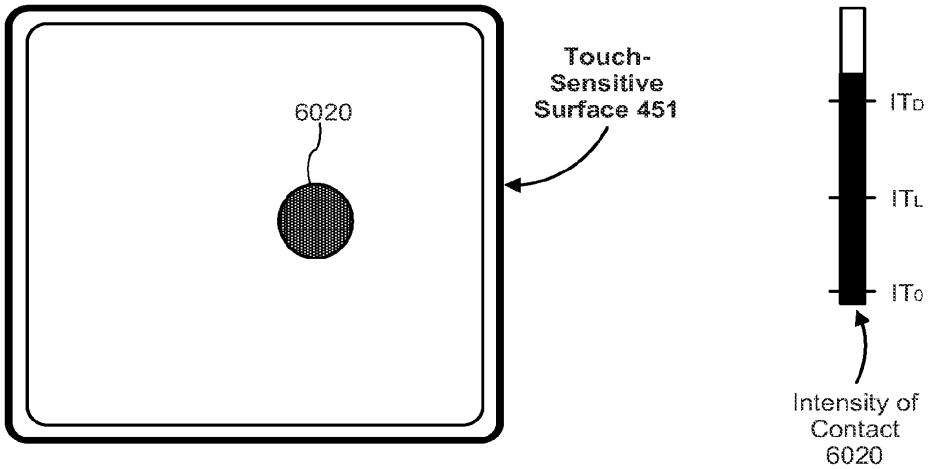
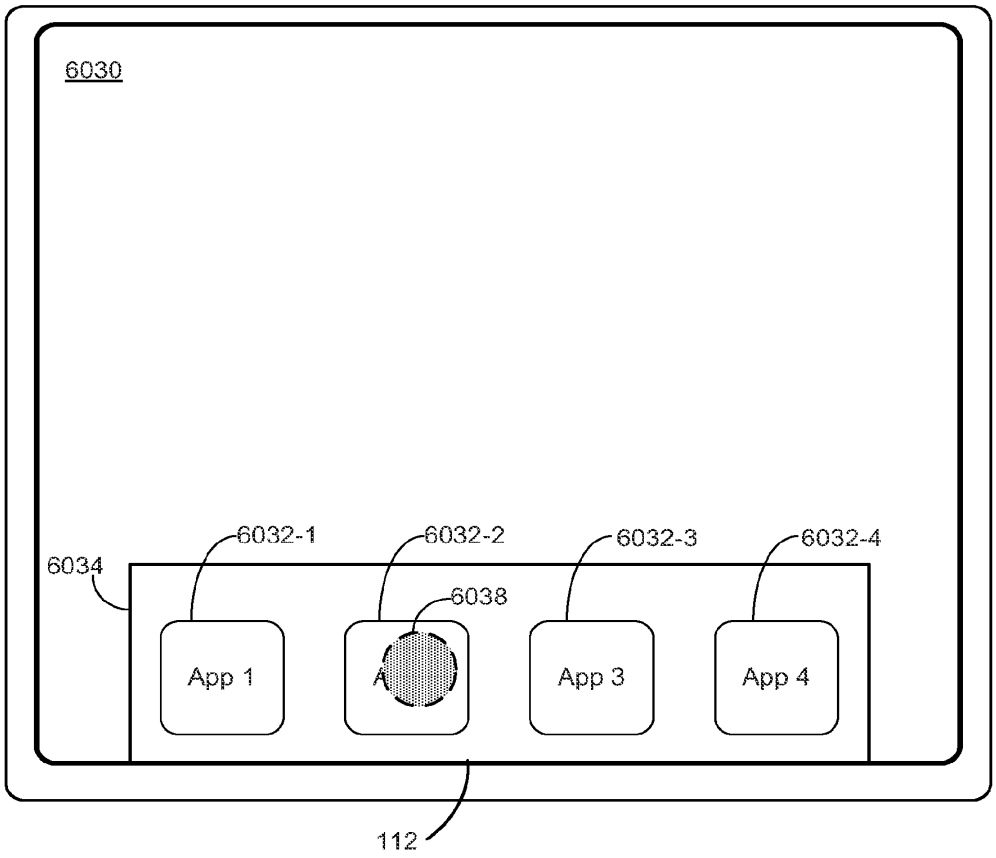

6020
Touch-Sensitive Surface 451
ITD
ITL
ITO
Intensity of Contact 6020

Figure 11L


6030
6032-1
6032-2
6032-3
6032-4
6034
6038
App 1
App 3
App 4
112

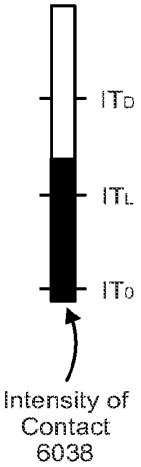
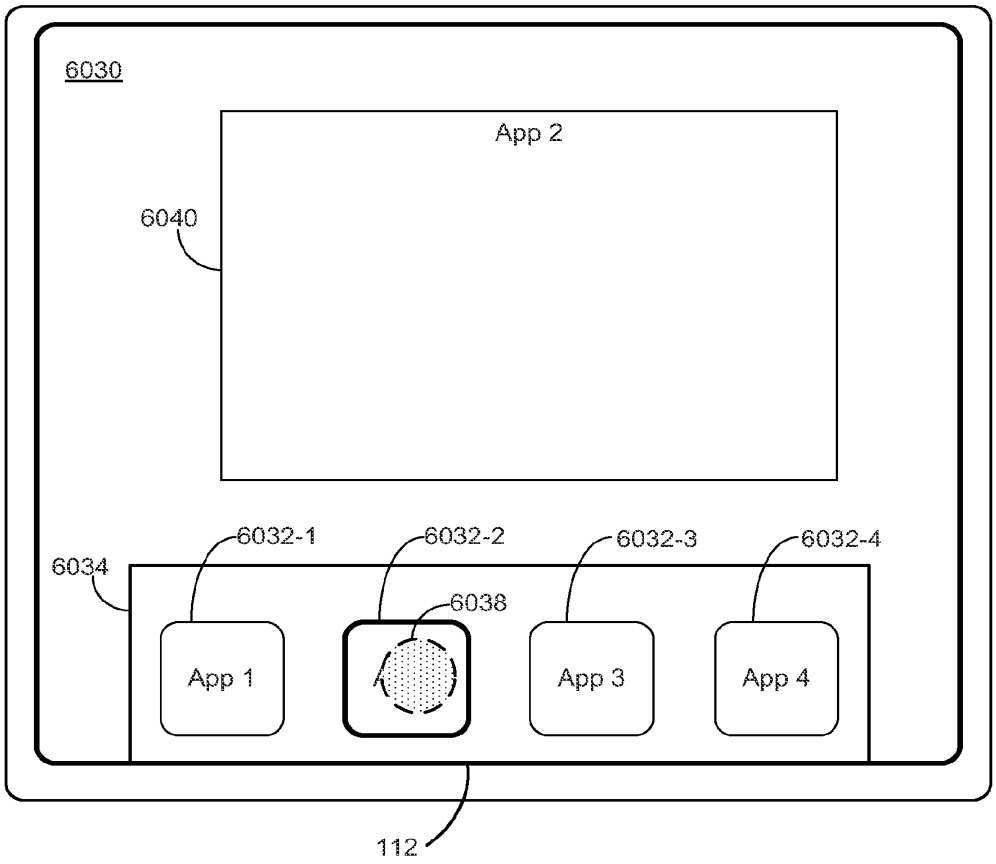

ITD
ITL
ITD
Intensity of Contact 6038

Figure 11M


6030
App 2
6040
6032-1
6032-2
6032-3
6032-4
6034
6038
App 1
App 3
App 4
112

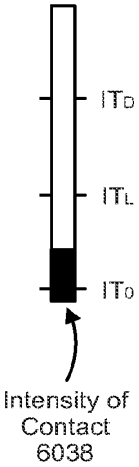
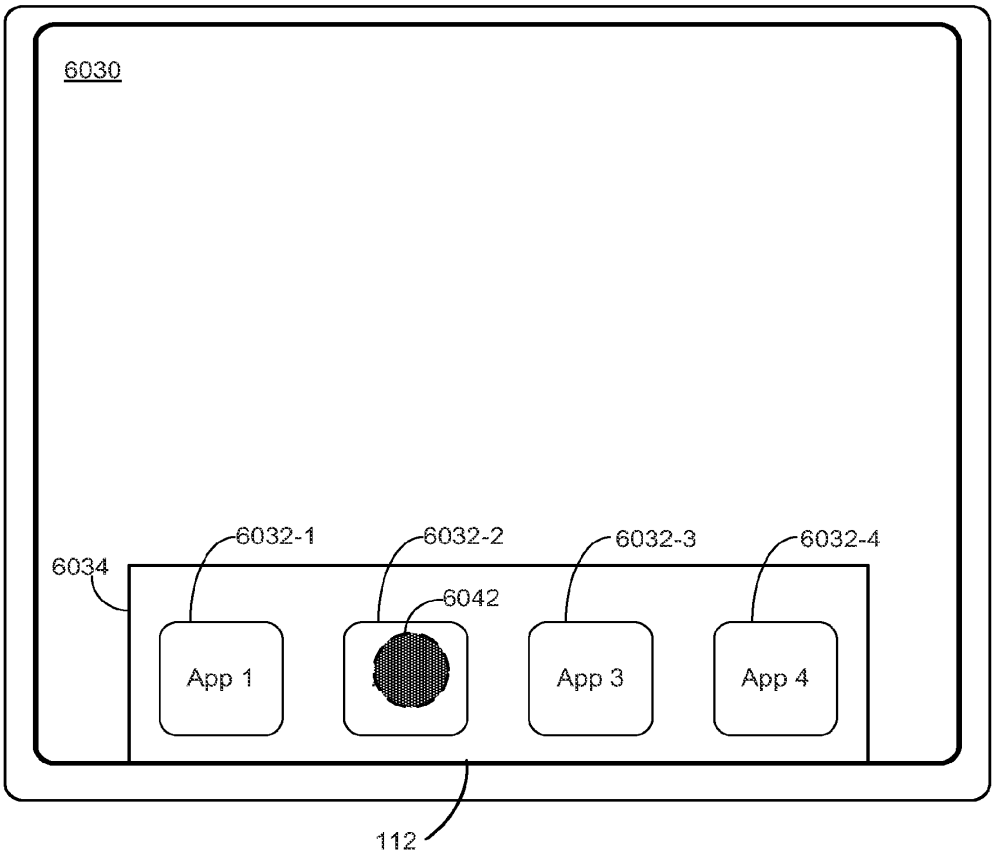

ITD
ITL
ITo
Intensity of Contact 6038

Figure 11N


6030
6032-1
6032-2
6032-3
6032-4
6034
6042
App 1
App 3
App 4
112

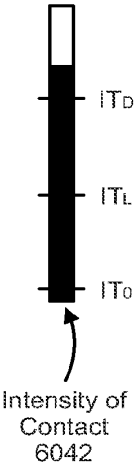

ITD
ITL
ITO
Intensity of Contact 6042

Figure 11O

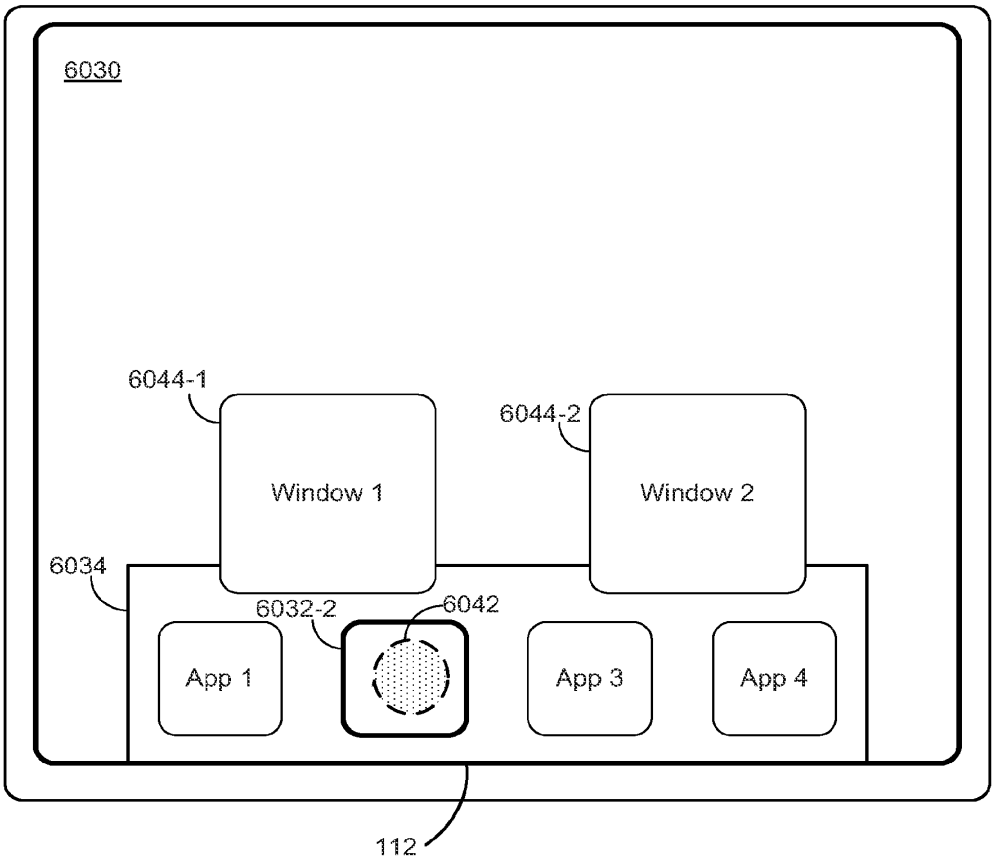

6030
6044-1
Window 1
6044-2
Window 2
6034
6032-2
6042
App 1
App 3
App 4
112
ITD
ITL
ITo
Intensity of Contact 6042

Figure 11P

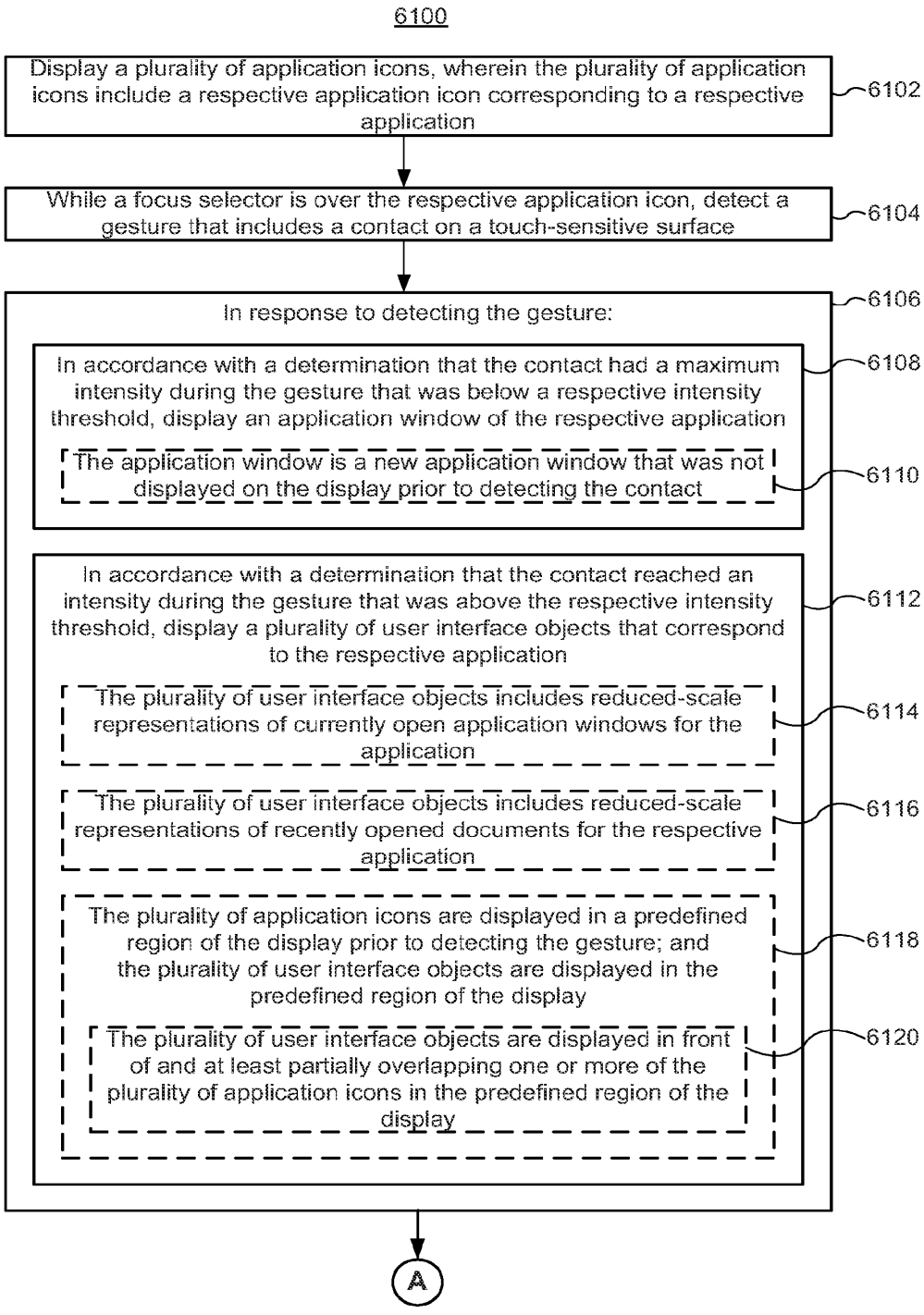

6100
Display a plurality of application icons, wherein the plurality of application icons include a respective application icon corresponding to a respective application
6102
While a focus selector is over the respective application icon, detect a gesture that includes a contact on a touch-sensitive surface
6104
In response to detecting the gesture:
6106
In accordance with a determination that the contact had a maximum intensity during the gesture that was below a respective intensity threshold, display an application window of the respective application
6108
The application window is a new application window that was not displayed on the display prior to detecting the contact
6110
In accordance with a determination that the contact reached an intensity during the gesture that was above the respective intensity threshold, display a plurality of user interface objects that correspond to the respective application
6112
The plurality of user interface objects includes reduced-scale representations of currently open application windows for the application
6114
The plurality of user interface objects includes reduced-scale representations of recently opened documents for the respective application
6116
The plurality of application icons are displayed in a predefined region of the display prior to detecting the gesture; and the plurality of user interface objects are displayed in the predefined region of the display
6118
The plurality of user interface objects are displayed in front of and at least partially overlapping one or more of the plurality of application icons in the predefined region of the display
6120
A

Figure 12A

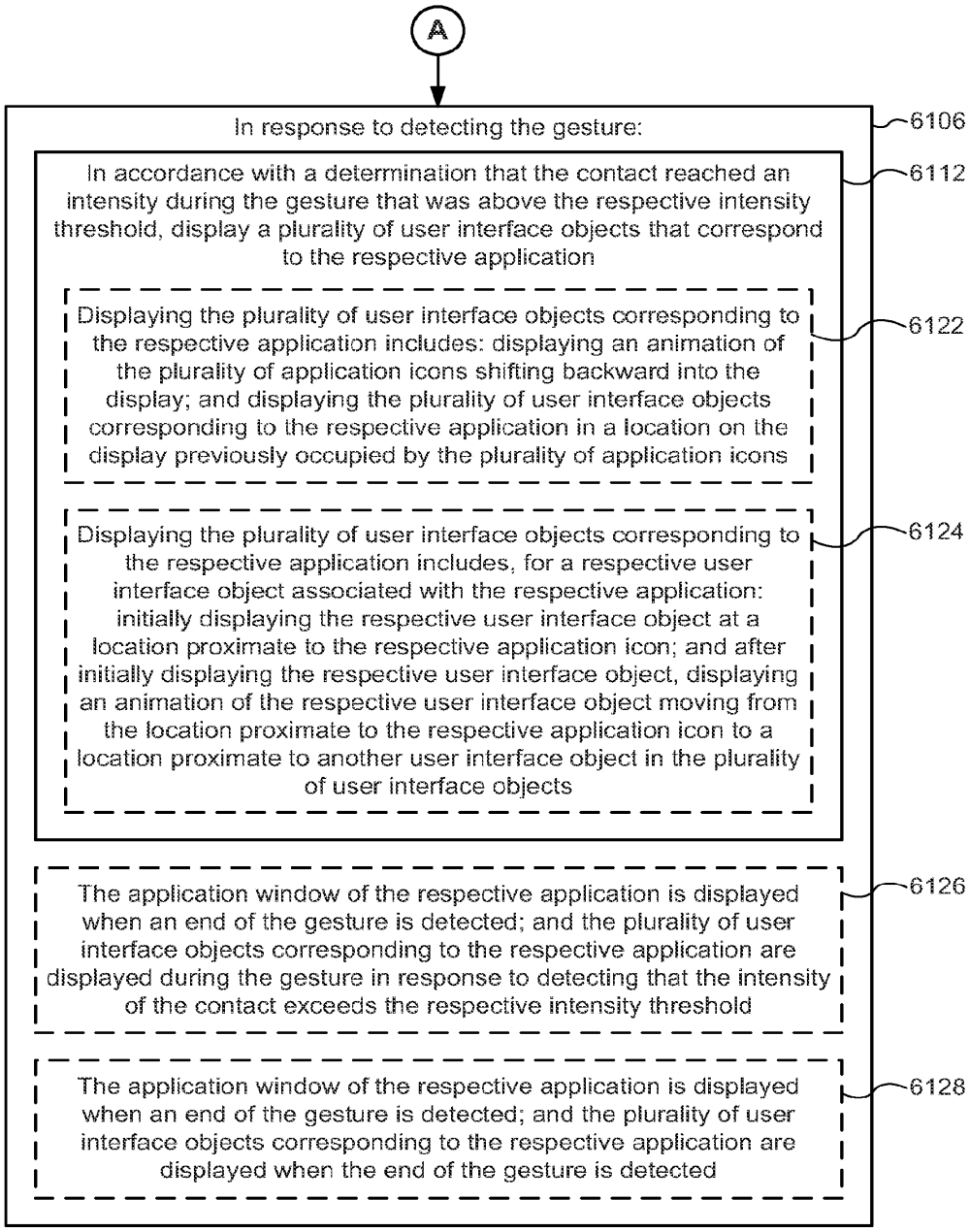

A
In response to detecting the gesture:
6106
In accordance with a determination that the contact reached an intensity during the gesture that was above the respective intensity threshold, display a plurality of user interface objects that correspond to the respective application
6112
Displaying the plurality of user interface objects corresponding to the respective application includes: displaying an animation of the plurality of application icons shifting backward into the display; and displaying the plurality of user interface objects corresponding to the respective application in a location on the display previously occupied by the plurality of application icons
6122
Displaying the plurality of user interface objects corresponding to the respective application includes, for a respective user interface object associated with the respective application: initially displaying the respective user interface object at a location proximate to the respective application icon; and after initially displaying the respective user interface object, displaying an animation of the respective user interface object moving from the location proximate to the respective application icon to a location proximate to another user interface object in the plurality of user interface objects
6124
The application window of the respective application is displayed when an end of the gesture is detected; and the plurality of user interface objects corresponding to the respective application are displayed during the gesture in response to detecting that the intensity of the contact exceeds the respective intensity threshold
6126
The application window of the respective application is displayed when an end of the gesture is detected; and the plurality of user interface objects corresponding to the respective application are displayed when the end of the gesture is detected
6128

Figure 12B

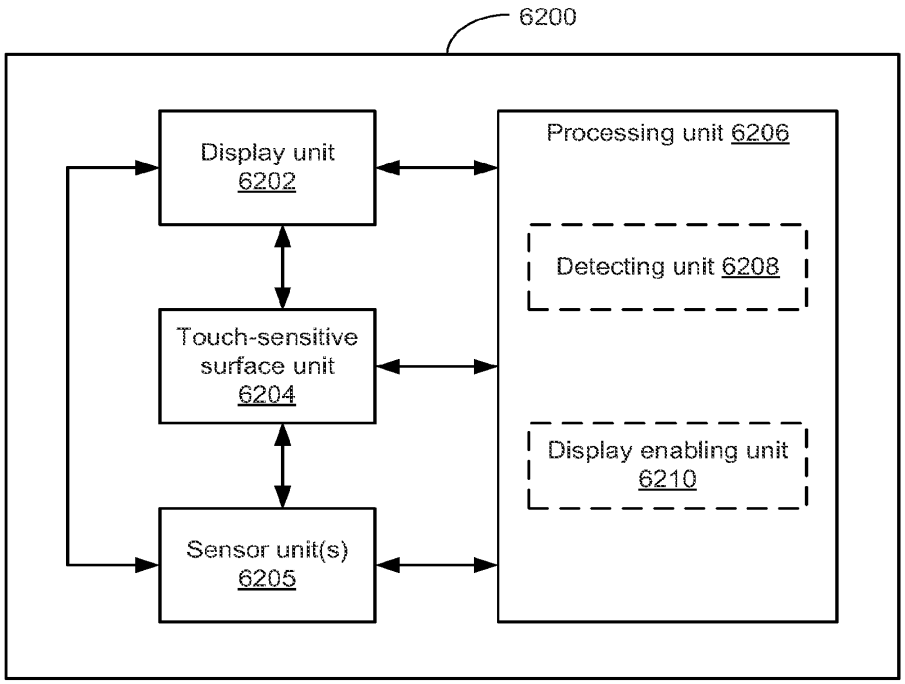

6200
Display unit 6202
Touch-sensitive surface unit 6204
Sensor unit(s) 6205
Processing unit 6206
Detecting unit 6208
Display enabling unit 6210

Figure 13

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(54) **Title**: DEVICE, METHOD, AND GRAPHICAL USER INTERFACE FOR TRANSITIONING BETWEEN TOUCH INPUT TO DISPLAY OUTPUT RELATIONSHIPS

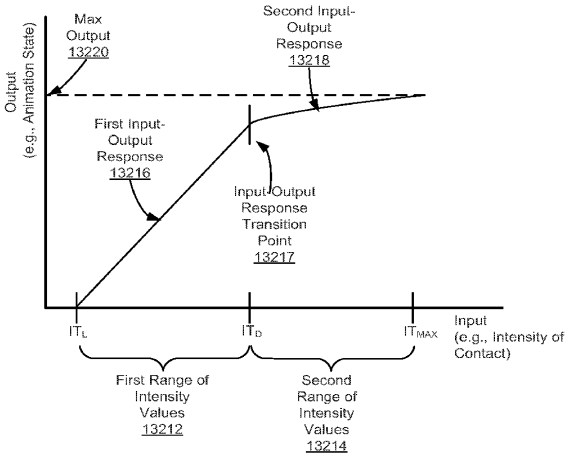


Figure 8L

(57) **Abstract**: An electronic device with a touch-sensitive surface, a display, and one or more sensors to detect intensity of contacts, detects a contact, determines a location and intensity of the contact on the touch-sensitive surface, and displays a response, the response being based at least in part on an input-output mapping of intensity to response at the contact location. The input-output mapping including a first input-output relationship between intensity and response over a first range of intensity values, a second input-output relationship between intensity and response over a second range of intensity values, and a transitional intensity value where the first range of intensity values meets or overlaps the second range of intensity values. At the transitional intensity value, the first input-output relationship has a first rate of change, the second input-output relationship has a second rate of change, and the first rate is substantially the same as the second rate.

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Device, Method, and Graphical User Interface for Transitioning between Touch Input to Display Output Relationships

RELATED APPLICATIONS

[0001] This application claims priority to U.S. Provisional Patent Application Serial No. 61/778,363, filed on March 12, 2013, entitled "Device, Method, and Graphical User Interface for Transitioning between Touch Input to Display Output Relationships;" U.S. Provisional Patent Application No. 61/747,278, filed December 29, 2012, entitled "Device, Method, and Graphical User Interface for Manipulating User Interface Objects with Visual and/or Haptic Feedback," which applications are incorporated by reference herein in their entirety.

[0002] This application is also related to the following: U.S. Provisional Patent Application Serial No. 61/778,092, filed on March 12, 2013, entitled "Device, Method, and Graphical User Interface for Selecting Object within a Group of Objects;" U.S. Provisional Patent Application Serial No. 61/778,125, filed on March 12, 2013, entitled "Device, Method, and Graphical User Interface for Navigating User Interface Hierarchies;" U.S. Provisional Patent Application Serial No. 61/778,156, filed on March 12, 2013, entitled "Device, Method, and Graphical User Interface for Manipulating Framed Graphical Objects;" U.S. Provisional Patent Application Serial No. 61/778,179, filed on March 12, 2013, entitled "Device, Method, and Graphical User Interface for Scrolling Nested Regions;" U.S. Provisional Patent Application Serial No. 61/778,171, filed on March 12, 2013, entitled "Device, Method, and Graphical User Interface for Displaying Additional Information in Response to a User Contact;" U.S. Provisional Patent Application Serial No. 61/778,191, filed on March 12, 2013, entitled "Device, Method, and Graphical User Interface for Displaying User Interface Objects Corresponding to an Application;" U.S. Provisional Patent Application Serial No. 61/778,211, filed on March 12, 2013, entitled "Device, Method, and Graphical User Interface for Facilitating User Interaction with Controls in a User Interface;" U.S. Provisional Patent Application Serial No. 61/778,239, filed on March 12, 2013, entitled "Device, Method, and Graphical User Interface for Forgoing Generation of Tactile Output for a Multi-Contact Gesture;" U.S. Provisional Patent Application Serial No. 61/778,284, filed on March 12, 2013, entitled "Device, Method, and Graphical User Interface for Providing Tactile Feedback for Operations Performed in a User Interface;" U.S. Provisional

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Patent Application Serial No. 61/778,287, filed on March 12, 2013, entitled "Device, Method, and Graphical User Interface for Providing Feedback for Changing Activation States of a User Interface Object;" U.S. Provisional Patent Application Serial No. 61/778,367, filed on March 12, 2013, entitled "Device, Method, and Graphical User Interface for Moving a User Interface Object Based on an Intensity of a Press Input;" U.S. Provisional Patent Application Serial No. 61/778,265, filed on March 12, 2013, entitled "Device, Method, and Graphical User Interface for Transitioning between Display States in Response to a Gesture;" U.S. Provisional Patent Application Serial No. 61/778,373, filed on March 12, 2013, entitled "Device, Method, and Graphical User Interface for Managing Activation of a Control Based on Contact Intensity;" U.S. Provisional Patent Application Serial No. 61/778,412, filed on March 13, 2013, entitled "Device, Method, and Graphical User Interface for Displaying Content Associated with a Corresponding Affordance;" U.S. Provisional Patent Application Serial No. 61/778,413, filed on March 13, 2013, entitled "Device, Method, and Graphical User Interface for Selecting User Interface Objects;" U.S. Provisional Patent Application Serial No. 61/778,414, filed on March 13, 2013, entitled "Device, Method, and Graphical User Interface for Moving and Dropping a User Interface Object;" U.S. Provisional Patent Application Serial No. 61/778,416, filed on March 13, 2013, entitled "Device, Method, and Graphical User Interface for Determining Whether to Scroll or Select Content;" and U.S. Provisional Patent Application Serial No. 61/778,418, filed on March 13, 2013, entitled "Device, Method, and Graphical User Interface for Switching between User Interfaces," which are incorporated herein by reference in their entirety.

[0003] This application is also related to the following: U.S. Provisional Patent Application Serial No. 61/645,033, filed on May 9, 2012, entitled "Adaptive Haptic Feedback for Electronic Devices;" U.S. Provisional Patent Application Serial No. 61/665,603, filed on June 28, 2012, entitled "Adaptive Haptic Feedback for Electronic Devices;" and U.S. Provisional Patent Application Serial No. 61/681,098, filed on August 8, 2012, entitled "Adaptive Haptic Feedback for Electronic Devices," which are incorporated herein by reference in their entirety.

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TECHNICAL FIELD

[0004] This relates generally to electronic devices with touch-sensitive surfaces, including but not limited to electronic devices with touch-sensitive surfaces that detect inputs for manipulating user interfaces.

BACKGROUND

[0005] The use of touch-sensitive surfaces as input devices for computers and other electronic computing devices has increased significantly in recent years. Exemplary touch-sensitive surfaces include touch pads and touch screen displays. Such surfaces are widely used to manipulate user interface objects on a display.

[0006] Exemplary manipulations include adjusting the position and/or size of one or more user interface objects or activating buttons or opening files/applications represented by user interface objects, as well as associating metadata with one or more user interface objects or otherwise manipulating user interfaces. Exemplary user interface objects include digital images, video, text, icons, control elements such as buttons and other graphics. A user will, in some circumstances, need to perform such manipulations on user interface objects in a file management program (e.g., Finder from Apple Inc. of Cupertino, California), an image management application (e.g., Aperture or iPhoto from Apple Inc. of Cupertino, California), a digital content (e.g., videos and music) management application (e.g., iTunes from Apple Inc. of Cupertino, California), a drawing application, a presentation application (e.g., Keynote from Apple Inc. of Cupertino, California), a word processing application (e.g., Pages from Apple Inc. of Cupertino, California), a website creation application (e.g., iWeb from Apple Inc. of Cupertino, California), a disk authoring application (e.g., iDVD from Apple Inc. of Cupertino, California), or a spreadsheet application (e.g., Numbers from Apple Inc. of Cupertino, California).

[0007] But existing methods for performing these manipulations are cumbersome and inefficient. In addition, existing methods take longer than necessary, thereby wasting energy. This latter consideration is particularly important in battery-operated devices.

SUMMARY

[0008] Accordingly, there is a need for electronic devices with faster, more efficient methods and interfaces for manipulating user interfaces. Such methods and interfaces optionally complement or replace conventional methods for manipulating user interfaces.

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Such methods and interfaces reduce the cognitive burden on a user and produce a more efficient human-machine interface. For battery-operated devices, such methods and interfaces conserve power and increase the time between battery charges.

[0009] The above deficiencies and other problems associated with user interfaces for electronic devices with touch-sensitive surfaces are reduced or eliminated by the disclosed devices. In some embodiments, the device is a desktop computer. In some embodiments, the device is portable (e.g., a notebook computer, tablet computer, or handheld device). In some embodiments, the device has a touchpad. In some embodiments, the device has a touch-sensitive display (also known as a “touch screen” or "touch screen display"). In some embodiments, the device has a graphical user interface (GUI), one or more processors, memory and one or more modules, programs or sets of instructions stored in the memory for performing multiple functions. In some embodiments, the user interacts with the GUI primarily through finger contacts and gestures on the touch-sensitive surface. In some embodiments, the functions optionally include image editing, drawing, presenting, word processing, website creating, disk authoring, spreadsheet making, game playing, telephoning, video conferencing, e-mailing, instant messaging, workout support, digital photographing, digital videoing, web browsing, digital music playing, and/or digital video playing. Executable instructions for performing these functions are, optionally, included in a non-transitory computer readable storage medium or other computer program product configured for execution by one or more processors.

[0010] There is a need for electronic devices with faster, more efficient methods for assigning respective portions of an aggregate intensity to a plurality of contacts. Such methods may complement or replace conventional methods for assigning respective portions of an aggregate intensity to a plurality of contacts. Such methods reduce the cognitive burden on a user and produce a more efficient human-machine interface. For battery-operated devices, such methods conserve power and increase the time between battery charges.

[0011] In accordance with some embodiments, a method is performed at an electronic device with a display, a touch-sensitive surface and a plurality of intensity sensors to detect intensity of contacts with the touch-sensitive surface. The method includes detecting, on the touch-sensitive surface, a plurality of contacts. While detecting the plurality of contacts, the method further includes: receiving a first intensity measurement from a first intensity sensor of the plurality of intensity sensors; receiving a second intensity measurement from a second intensity sensor of the plurality of intensity sensors, where the first intensity sensor is

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different from the second intensity sensor; and assigning a first portion of an aggregate intensity of the contacts to the first contact and assigning a second portion of the aggregate intensity to the second contact. The method includes assigning the aggregate intensity based at least in part on: the first intensity measurement; the second intensity measurement; a location of the first intensity sensor relative to the touch-sensitive surface; a location of the second intensity sensor relative to the touch-sensitive surface; and a comparison between values of a set of one or more properties of the first contact and corresponding values of the set of one or more properties of the second contact. In response to detecting the plurality of contacts, the method further includes performing an operation based at least in part on the portion of the aggregate intensity assigned to the first contact.

[0012] In accordance with some embodiments, an electronic device includes: a display unit configured to display information; a touch-sensitive surface to receive contacts; a plurality of intensity sensor units to detect intensity of contacts with the touch-sensitive surface; and a processing unit coupled to the display unit, the touch-sensitive surface unit, and the plurality of sensor units. The processing unit is configured to detect, on the touch-sensitive surface unit, a plurality of contacts. While detecting the plurality of contacts, the processing unit is further configured to: receive a first intensity measurement from a first intensity sensor unit of the plurality of intensity sensors unit; receive a second intensity measurement from a second intensity sensor unit of the plurality of intensity sensor units, where the first intensity sensor unit is different from the second intensity sensor unit; and assign a first portion of an aggregate intensity of the contacts to the first contact and a second portion of the aggregate intensity to the second contact. The processing unit is configured to assign the aggregate intensity to the plurality of contacts based at least in part on: the first intensity measurement; the second intensity measurement; a location of the first intensity sensor unit relative to the touch-sensitive surface unit; a location of the second intensity sensor unit relative to the touch-sensitive surface unit; and a comparison between values of a set of one or more properties of the first contact and corresponding values of the set of one or more properties of the second contact. The processing unit is further configured to respond to detecting the plurality of contacts by performing an operation based at least in part on the portion of the aggregate intensity assigned to the first contact.

[0013] Thus, electronic devices with displays, touch-sensitive surfaces and a plurality of intensity sensors to detect intensity of contacts with the touch-sensitive surface are provided with faster, more efficient methods for assigning respective portions of an aggregate

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intensity to a plurality of contacts, thereby increasing the effectiveness, efficiency, and user satisfaction with such devices. Such methods may complement or replace conventional methods for assigning respective portions of an aggregate intensity to a plurality of contacts.

[0014] An electronic device detects, on a touch-sensitive surface, a plurality of contacts via a plurality of intensity sensors. While detecting the plurality of contacts, the device assigns portions of an aggregate intensity of the contacts to each of the plurality of contacts based on: the first intensity measurement received from a first intensity sensor; the second intensity measurement received from a second intensity sensor; a location of the first intensity sensor relative to the touch-sensitive surface; a location of the second intensity sensor relative to the touch-sensitive surface; and a comparison between values of a set of one or more properties of the first contact and corresponding values of the second contact. In response to detecting the plurality of contacts, the device performs an operation based at least in part on the portion of the aggregate intensity assigned to the first contact.

[0015] There is a need for electronic devices with faster, more efficient methods and interfaces for transitioning between touch input to display output relationships. Such methods and interfaces may complement or replace conventional methods for transitioning between touch input to display output relationships. Such methods and interfaces reduce the cognitive burden on a user and produce a more efficient human-machine interface. For battery-operated devices, such methods and interfaces conserve power and increase the time between battery charges.

[0016] In accordance with some embodiments, a method is performed at an electronic device with a touch-sensitive surface and a display, where the device includes one or more sensors to detect intensity of contacts with the touch-sensitive surface. The method includes detecting a contact on the touch-sensitive surface, determining a location of the contact on the touch-sensitive surface, determining an intensity of the contact on the touch-sensitive surface, and displaying a response in accordance with the detected contact, the response being based at least in part on an input-output mapping of intensity to response at the location of the contact on the touch-sensitive surface. The input-output mapping includes, for a respective location on the touch-sensitive surface, a first input-output relationship (e.g., touch input to display output) between intensity and response over a first range of intensity values, a second input-output relationship between intensity and response over a second range of intensity values, the second range of intensity values being different from the first range of intensity values, and a transitional intensity value where the first range of intensity values meets or

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overlaps the second range of intensity values, where, at the transitional intensity value, the first input-output relationship has a first rate of change of response with change in intensity, the second input-output relationship has a second rate of change of response with change in intensity, and the first rate of change is substantially the same as the second rate of change.

[0017] In accordance with some embodiments, an electronic device includes a display unit configured to display a response in accordance with a detected contact, a touch-sensitive surface unit configured to receive user contacts, one or more sensor units configured to detect intensity of contacts with the touch-sensitive surface unit, and a processing unit coupled to the display unit, the touch-sensitive surface unit, and the sensor units. The processing unit is configured to detect a contact on the touch-sensitive surface unit, determine a location of the contact on the touch-sensitive surface unit, determine an intensity of the contact on the touch-sensitive surface unit, and enable display of a response in accordance with the detected contact, the response being based at least in part on an input-output mapping of intensity to response at the location of the contact on the touch-sensitive surface unit. The input-output mapping includes, for a respective location on the touch-sensitive surface unit, a first input-output relationship between intensity and response over a first range of intensity values, a second input-output relationship between intensity and response over a second range of intensity values, the second range of intensity values being different from the first range of intensity values, and a transitional intensity value where the first range of intensity values meets or overlaps the second range of intensity values, where, at the transitional intensity value, the first input-output relationship has a first rate of change of response with change in intensity, the second input-output relationship has a second rate of change of response with change in intensity, and the first rate of change is substantially the same as the second rate of change.

[0018] Thus, electronic devices with displays, touch-sensitive surfaces and one or more sensors to detect intensity of contacts with the touch-sensitive surface are provided with faster, more efficient methods and interfaces for transitioning between touch input to display output relationships, thereby increasing the effectiveness, efficiency, and user satisfaction with such devices. Such methods and interfaces may complement or replace conventional methods for transitioning between touch input to display output relationships.

[0019] There is a need for electronic devices with faster, more efficient methods and interfaces for adjusting outputs with changes in contact intensity and varying dynamic range of intensity detection. Such methods and interfaces may complement or replace conventional

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methods for adjusting outputs with changes in contact intensity and varying dynamic range of intensity detection. Such methods and interfaces reduce the cognitive burden on a user and produce a more efficient human-machine interface. For battery-operated devices, such methods and interfaces conserve power and increase the time between battery charges.

[0020] In accordance with some embodiments, a method is performed at an electronic device with a touch-sensitive surface and a display, where the device includes one or more sensors to detect intensity of contacts with the touch-sensitive surface. The method includes detecting a contact on the touch-sensitive surface, and determining a respective location of the contact on the touch-sensitive surface, where the respective location on the touch-sensitive surface has a respective dynamic range for detecting intensity of the contact. The method further includes determining an intensity of the contact on the touch-sensitive surface at the respective location, detecting a change in intensity of the contact, and in response to detecting the change in intensity of the contact at the respective location on the touch-sensitive surface, adjusting an output of the device, where, in accordance with a determination that the respective location has a first dynamic range, the output is adjusted in accordance with the change in the intensity of the contact at the respective location and a first input-output mapping of intensity to response that corresponds to the first dynamic range, and, in accordance with a determination that the respective location has a second dynamic range that is different from the first dynamic range, the output is adjusted in accordance with the change in the intensity of the contact at the respective location and a second input-output mapping of intensity to response that corresponds to the second dynamic range, where the second input-output mapping is different from the first input-output mapping.

[0021] In accordance with some embodiments, an electronic device includes a display unit, a touch-sensitive surface unit configured to receive user contacts, one or more sensor units configured to detect intensity of contacts with the touch-sensitive surface unit, and a processing unit coupled to the display unit, the touch-sensitive surface unit, and the sensor units. The processing unit is configured to detect a contact on the touch-sensitive surface unit, determine a respective location of the contact on the touch-sensitive surface unit, where the respective location on the touch-sensitive surface unit has a respective dynamic range for detecting intensity of the contact. The processing unit is further configured to determine an intensity of the contact on the touch-sensitive surface unit at the respective location, detect a change in intensity of the contact, and, in response to detecting the change in intensity of the contact at the respective location on the touch-sensitive surface, adjust an output of the

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device, where, in accordance with a determination that the respective location has a first dynamic range, the output is adjusted in accordance with the change in the intensity of the contact at the respective location and a first input-output mapping of intensity to response that corresponds to the first dynamic range, and, in accordance with a determination that the respective location has a second dynamic range that is different from the first dynamic range, the output is adjusted in accordance with the change in the intensity of the contact at the respective location and a second input-output mapping of intensity to response that corresponds to the second dynamic range, where the second input-output mapping is different from the first input-output mapping.

[0022] Thus, electronic devices with displays, touch-sensitive surfaces and one or more sensors to detect intensity of contacts with the touch-sensitive surface are provided with faster, more efficient methods and interfaces for adjusting outputs with changes in contact intensity and varying dynamic range of intensity detection, thereby increasing the effectiveness, efficiency, and user satisfaction with such devices. Such methods and interfaces may complement or replace conventional methods for adjusting outputs with changes in contact intensity and varying dynamic range of intensity detection.

[0023] In accordance with some embodiments, an electronic device includes a display, a touch-sensitive surface, optionally one or more sensors to detect intensity of contacts with the touch-sensitive surface, one or more processors, memory, and one or more programs; the one or more programs are stored in the memory and configured to be executed by the one or more processors and the one or more programs include instructions for performing the operations of any of the methods referred to in paragraph [0045]. In accordance with some embodiments, a graphical user interface on an electronic device with a display, a touch-sensitive surface, optionally one or more sensors to detect intensity of contacts with the touch-sensitive surface, a memory, and one or more processors to execute one or more programs stored in the memory includes one or more of the elements displayed in any of the methods referred to in paragraph [0045], which are updated in response to inputs, as described in any of the methods referred to in paragraph [0045]. In accordance with some embodiments, a computer readable storage medium has stored therein instructions which when executed by an electronic device with a display, a touch-sensitive surface, and optionally one or more sensors to detect intensity of contacts with the touch-sensitive surface, cause the device to perform the operations of any of the methods referred to in paragraph [0045]. In accordance with some embodiments, an electronic device includes: a display, a

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touch-sensitive surface, and optionally one or more sensors to detect intensity of contacts with the touch-sensitive surface; and means for performing the operations of any of the methods referred to in paragraph [0045]. In accordance with some embodiments, an information processing apparatus, for use in an electronic device with a display and a touch-sensitive surface, optionally one or more sensors to detect intensity of contacts with the touch-sensitive surface, includes means for performing the operations of any of the methods referred to in paragraph [0045].

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] For a better understanding of the various described embodiments, reference should be made to the Description of Embodiments below, in conjunction with the following drawings in which like reference numerals refer to corresponding parts throughout the figures.

[0025] Figure 1A is a block diagram illustrating a portable multifunction device with a touch-sensitive display in accordance with some embodiments.

[0026] Figure 1B is a block diagram illustrating exemplary components for event handling in accordance with some embodiments.

[0027] Figure 2 illustrates a portable multifunction device having a touch screen in accordance with some embodiments.

[0028] Figure 3 is a block diagram of an exemplary multifunction device with a display and a touch-sensitive surface in accordance with some embodiments.

[0029] Figure 4A illustrates an exemplary user interface for a menu of applications on a portable multifunction device in accordance with some embodiments.

[0030] Figure 4B illustrates an exemplary user interface for a multifunction device with a touch-sensitive surface that is separate from the display in accordance with some embodiments.

[0031] Figures 5A-5L illustrate exemplary user interfaces and contacts with a touch-sensitive surface that are assigned respective portions of an aggregate intensity in accordance with some embodiments.

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[0032] Figures 6A-6C are flow diagrams illustrating a method of assigning respective portions of an aggregate intensity to a plurality of contacts in accordance with some embodiments.

[0033] Figure 7 is a functional block diagram of an electronic device in accordance with some embodiments.

[0034] Figures 8A-8V illustrate exemplary user interfaces for transitioning between touch input to display output relationships in accordance with some embodiments.

[0035] Figures 9A-9C are flow diagrams illustrating a method of transitioning between touch input to display output relationships in accordance with some embodiments.

[0036] Figure 10 is a functional block diagram of an electronic device in accordance with some embodiments.

[0037] Figure 11A illustrates mappings between ranges of intensity values and output responses, for one or more contacts on a touch-sensitive surface, in accordance with some embodiments.

[0038] Figures 11B-11U illustrate exemplary user interfaces for adjusting outputs with changes in contact intensity and varying dynamic range of intensity detection in accordance with some embodiments.

[0039] Figures 12A-12D are flow diagrams illustrating a method of adjusting outputs with changes in contact intensity and varying dynamic range of intensity detection in accordance with some embodiments.

[0040] Figure 13 is a functional block diagram of an electronic device in accordance with some embodiments.

DESCRIPTION OF EMBODIMENTS

[0041] The methods, devices and GUIs described herein provide visual and/or haptic feedback that makes manipulation of user interface objects more efficient and intuitive for a user. For example, in a system where the clicking action of a trackpad is decoupled from the contact intensity (e.g., contact force, contact pressure, or a substitute therefore) that is needed to reach an activation threshold, the device can generate different tactile outputs (e.g., "different clicks") for different activation events (e.g., so that clicks that accomplish a particular result are differentiated from clicks that do not produce any result or that

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accomplish a different result from the particular result). Additionally, tactile outputs can be generated in response to other events that are not related to increasing intensity of a contact, such as generating a tactile output (e.g., a "detent") when a user interface object is moved to a particular position, boundary or orientation, or when an event occurs at the device.

[0042] Additionally, in a system where a trackpad or touch-screen display is sensitive to a range of contact intensity that includes more than one or two specific intensity values (e.g., more than a simple on/off, binary intensity determination), the user interface can provide responses (e.g., visual or tactile cues) that are indicative of the intensity of the contact within the range. In some implementations, a pre-activation-threshold response and/or a post-activation-threshold response to an input are displayed as continuous animations. As one example of such a response, a preview of an operation is displayed in response to detecting an increase in contact intensity that is still below an activation threshold for performing the operation. As another example of such a response, an animation associated with an operation continues even after the activation threshold for the operation has been reached. Both of these examples provide a user with a continuous response to the force or pressure of a user's contact, which provides a user with visual and/or haptic feedback that is richer and more intuitive. More specifically, such continuous force responses give the user the experience of being able to press lightly to preview an operation and/or press deeply to push "past" or "through" a predefined user interface state corresponding to the operation.

[0043] Additionally, for a device with a touch-sensitive surface that is sensitive to a range of contact intensity, multiple contact intensity thresholds can be monitored by the device and different functions can be mapped to different contact intensity thresholds. This serves to increase the available "gesture space" providing easy access to advanced features for users who know that increasing the intensity of a contact at or beyond a second "deep press" intensity threshold will cause the device to perform a different operation from an operation that would be performed if the intensity of the contact is between a first "activation" intensity threshold and the second "deep press" intensity threshold. An advantage of assigning additional functionality to a second "deep press" intensity threshold while maintaining familiar functionality at a first "activation" intensity threshold is that inexperienced users who are, in some circumstances, confused by the additional functionality can use the familiar functionality by just applying an intensity up to the first "activation" intensity threshold, whereas more experienced users can take advantage of the additional functionality by applying an intensity at the second "deep press" intensity threshold.

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[0044] Additionally, for a device with a touch-sensitive surface that is sensitive to a range of contact intensity, the device can provide additional functionality by allowing users to perform complex operations with a single continuous contact. For example, when selecting a group of objects, a user can move a continuous contact around the touch-sensitive surface and can press while dragging (e.g., applying an intensity greater than a "deep press" intensity threshold) to add additional elements to a selection. In this way, a user can intuitively interact with a user interface where pressing harder with a contact causes objects in the user interface to be "stickier."

[0045] A number of different approaches to providing an intuitive user interface on a device where a clicking action is decoupled from the force that is needed to reach an activation threshold and/or the device is sensitive to a wide range of contact intensities are described below. Using one or more of these approaches (optionally in conjunction with each other) helps to provide a user interface that intuitively provides users with additional information and functionality, thereby reducing the user's cognitive burden and improving the human-machine interface. Such improvements in the human-machine interface enable users to use the device faster and more efficiently. For battery-operated devices, these improvements conserve power and increase the time between battery charges. For ease of explanation, systems, methods and user interfaces for including illustrative examples of some of these approaches are described below, as follows:

- Many electronic devices sense a pressure of a user input. For example, a device with a pressure sensitive button determines an amount that the button is depressed by the user based on a pressure measurement of a pressure sensor integrated with the button. However, such methods do not provide a way to estimate the intensity of multiple different simultaneously detected contacts and thus do not provide a way to interact with an intensity sensitive user interface with multiple contacts. The device improves on these methods by assigning a first portion of an aggregate intensity (e.g., a sum of intensity measurements received from each intensity sensor of a plurality of intensity sensors) of a plurality of contacts on a touch-sensitive surface to a first contact of the plurality of contacts and by assigning a second portion of the aggregate intensity to a second contact of the plurality of contacts, while detecting the plurality of contacts on the touch-sensitive surface, thereby enabling the device to estimate intensity of multiple simultaneously detected contacts and use this information to control convenient and efficient user interfaces. In particular, Figures 5A-5L illustrate

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exemplary user interfaces and contacts with a touch-sensitive surface that are assigned respective portions of an aggregate intensity to a plurality of contacts. Figures 6A-6C are flow diagrams illustrating a method of assigning respective portions of an aggregate intensity to a plurality of contacts. The depictions in Figures 5A-5L are used to illustrate the processes in Figures 6A-6C.

- Many electronic devices have graphical user interfaces that include various user interface objects that are controlled in accordance with input-output relationships between inputs and corresponding outputs. In some situations there is a constant input-output relationship between inputs and corresponding outputs. However, a constant input-output relationship can be distracting an inefficient for a user when there is a particular range of outputs that the user is likely to want to achieve. A simplistic variable input-output relationship can also be confusing and disconcerting to a user if the user notices discontinuities in the input-output relationship. The embodiments described below provide an efficient and intuitive way of transitioning between touch input to display output relationships when interacting with user interface objects, thereby enabling the device to control convenient and efficient user interfaces. In particular, Figures 8A-8V illustrate exemplary user interfaces for transitioning between touch input to display output relationships using inputs on a touch-sensitive surface. Figures 9A-9C are flow diagrams illustrating a method of transitioning between touch input to display output relationships using inputs on a touch-sensitive surface. The user interfaces in Figures 8A-8V are further used to illustrate the processes described below with reference to Figures 9A-9C.
- Many electronic devices have touch-sensitive surfaces. The touch-sensitive surfaces optionally utilizes multiple intensity sensors and have a maximum intensity detection threshold that varies with location on the touch-sensitive surface. This variation in maximum intensity detection threshold can be addressed by using a uniform maximum intensity detection threshold for the whole touch-sensitive surface that is a lowest common denominator maximum intensity detection threshold. However, this approach keeps the device from being used to its full potential and thus provides a less efficient and less effective user interface. The embodiments described below improve on these methods by dynamically adjusting input-output relationships to take advantage of maximum intensity detection thresholds that are higher than the maximum intensity thresholds on the least sensitive portions of the touch-sensitive

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surface. The embodiments described below provide an efficient and intuitive way of adjusting outputs with changes in contact intensity and varying dynamic range of intensity detection, thereby enabling the device to control convenient and efficient user interfaces. . In particular, Figures 11B-11U illustrate exemplary user interfaces for adjusting outputs with changes in contact intensity (e.g., corresponding to inputs on a touch-sensitive surface) and varying dynamic range of intensity detection in accordance with some embodiments. Figures 12A-12D are flow diagrams illustrating a method of adjusting outputs with changes in contact intensity (e.g., corresponding to inputs on a touch-sensitive surface) and varying dynamic range of intensity detection in accordance with some embodiments. The user interfaces in Figures 11B-11U are further used to illustrate the processes described below with reference to Figures 12A-12D.

EXEMPLARY DEVICES

[0046] Reference will now be made in detail to embodiments, examples of which are illustrated in the accompanying drawings. In the following detailed description, numerous specific details are set forth in order to provide a thorough understanding of the various described embodiments. However, it will be apparent to one of ordinary skill in the art that the various described embodiments may be practiced without these specific details. In other instances, well-known methods, procedures, components, circuits, and networks have not been described in detail so as not to unnecessarily obscure aspects of the embodiments.

[0047] It will also be understood that, although the terms first, second, etc. are, in some instances, used herein to describe various elements, these elements should not be limited by these terms. These terms are only used to distinguish one element from another. For example, a first contact could be termed a second contact, and, similarly, a second contact could be termed a first contact, without departing from the scope of the various described embodiments. The first contact and the second contact are both contacts, but they are not the same contact.

[0048] The terminology used in the description of the various described embodiments herein is for the purpose of describing particular embodiments only and is not intended to be limiting. As used in the description of the various described embodiments and the appended claims, the singular forms “a”, “an” and “the” are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will also be understood that the term

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"and/or" as used herein refers to and encompasses any and all possible combinations of one or more of the associated listed items. It will be further understood that the terms "includes," "including," "comprises," and/or "comprising," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

[0049] As used herein, the term "if" is, optionally, construed to mean "when" or "upon" or "in response to determining" or "in response to detecting," depending on the context. Similarly, the phrase "if it is determined" or "if [a stated condition or event] is detected" is, optionally, construed to mean "upon determining" or "in response to determining" or "upon detecting [the stated condition or event]" or "in response to detecting [the stated condition or event]," depending on the context.

[0050] Embodiments of electronic devices, user interfaces for such devices, and associated processes for using such devices are described. In some embodiments, the device is a portable communications device, such as a mobile telephone, that also contains other functions, such as PDA and/or music player functions. Exemplary embodiments of portable multifunction devices include, without limitation, the iPhone®, iPod Touch®, and iPad® devices from Apple Inc. of Cupertino, California. Other portable electronic devices, such as laptops or tablet computers with touch-sensitive surfaces (e.g., touch screen displays and/or touch pads), are, optionally, used. It should also be understood that, in some embodiments, the device is not a portable communications device, but is a desktop computer with a touch-sensitive surface (e.g., a touch screen display and/or a touch pad).

[0051] In the discussion that follows, an electronic device that includes a display and a touch-sensitive surface is described. It should be understood, however, that the electronic device optionally includes one or more other physical user-interface devices, such as a physical keyboard, a mouse and/or a joystick.

[0052] The device typically supports a variety of applications, such as one or more of the following: a drawing application, a presentation application, a word processing application, a website creation application, a disk authoring application, a spreadsheet application, a gaming application, a telephone application, a video conferencing application, an e-mail application, an instant messaging application, a workout support application, a photo management application, a digital camera application, a digital video camera

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application, a web browsing application, a digital music player application, and/or a digital video player application.

[0053] The various applications that are executed on the device optionally use at least one common physical user-interface device, such as the touch-sensitive surface. One or more functions of the touch-sensitive surface as well as corresponding information displayed on the device are, optionally, adjusted and/or varied from one application to the next and/or within a respective application. In this way, a common physical architecture (such as the touch-sensitive surface) of the device optionally supports the variety of applications with user interfaces that are intuitive and transparent to the user.

[0054] Attention is now directed toward embodiments of portable devices with touch-sensitive displays. Figure 1A is a block diagram illustrating portable multifunction device 100 with touch-sensitive displays 112 in accordance with some embodiments. Touch-sensitive display 112 is sometimes called a "touch screen" for convenience, and is sometimes known as or called a touch-sensitive display system. Device 100 includes memory 102 (which optionally includes one or more computer readable storage mediums), memory controller 122, one or more processing units (CPU's) 120, peripherals interface 118, RF circuitry 108, audio circuitry 110, speaker 111, microphone 113, input/output (I/O) subsystem 106, other input or control devices 116, and external port 124. Device 100 optionally includes one or more optical sensors 164. Device 100 optionally includes one or more intensity sensors 165 for detecting intensity of contacts on device 100 (e.g., a touch-sensitive surface such as touch-sensitive display system 112 of device 100). Device 100 optionally includes one or more tactile output generators 167 for generating tactile outputs on device 100 (e.g., generating tactile outputs on a touch-sensitive surface such as touch-sensitive display system 112 of device 100 or touchpad 355 of device 300). These components optionally communicate over one or more communication buses or signal lines 103.

[0055] As used in the specification and claims, the term "intensity" of a contact on a touch-sensitive surface refers to the force or pressure (force per unit area) of a contact (e.g., a finger contact) on the touch sensitive surface, or to a substitute (proxy) for the force or pressure of a contact on the touch sensitive surface. The intensity of a contact has a range of values that includes at least four distinct values and more typically includes hundreds of distinct values (e.g., at least 256). Intensity of a contact is, optionally, determined (or measured) using various approaches and various sensors or combinations of sensors. For

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example, one or more force sensors underneath or adjacent to the touch-sensitive surface are, optionally, used to measure force at various points on the touch-sensitive surface. In some implementations, force measurements from multiple force sensors are combined (e.g., a weighted average) to determine an estimated force of a contact. Similarly, a pressure-sensitive tip of a stylus is, optionally, used to determine a pressure of the stylus on the touch-sensitive surface. Alternatively, the size of the contact area detected on the touch-sensitive surface and/or changes thereto, the capacitance of the touch-sensitive surface proximate to the contact and/or changes thereto, and/or the resistance of the touch-sensitive surface proximate to the contact and/or changes thereto are, optionally, used as a substitute for the force or pressure of the contact on the touch-sensitive surface. In some implementations, the substitute measurements for contact force or pressure are used directly to determine whether an intensity threshold has been exceeded (e.g., the intensity threshold is described in units corresponding to the substitute measurements). In some implementations, the substitute measurements for contact force or pressure are converted to an estimated force or pressure and the estimated force or pressure is used to determine whether an intensity threshold has been exceeded (e.g., the intensity threshold is a pressure threshold measured in units of pressure).

[0056] As used in the specification and claims, the term "tactile output" refers to physical displacement of a device relative to a previous position of the device, physical displacement of a component (e.g., a touch-sensitive surface) of a device relative to another component (e.g., housing) of the device, or displacement of the component relative to a center of mass of the device that will be detected by a user with the user's sense of touch. For example, in situations where the device or the component of the device is in contact with a surface of a user that is sensitive to touch (e.g., a finger, palm, or other part of a user's hand), the tactile output generated by the physical displacement will be interpreted by the user as a tactile sensation corresponding to a perceived change in physical characteristics of the device or the component of the device. For example, movement of a touch-sensitive surface (e.g., a touch-sensitive display or trackpad) is, optionally, interpreted by the user as a "down click" or "up click" of a physical actuator button. In some cases, a user will feel a tactile sensation such as an "down click" or "up click" even when there is no movement of a physical actuator button associated with the touch-sensitive surface that is physically pressed (e.g., displaced) by the user's movements. As another example, movement of the touch-sensitive surface is, optionally, interpreted or sensed by the user as "roughness" of the touch-sensitive surface,

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even when there is no change in smoothness of the touch-sensitive surface. While such interpretations of touch by a user will be subject to the individualized sensory perceptions of the user, there are many sensory perceptions of touch that are common to a large majority of users. Thus, when a tactile output is described as corresponding to a particular sensory perception of a user (e.g., an "up click," a "down click," "roughness"), unless otherwise stated, the generated tactile output corresponds to physical displacement of the device or a component thereof that will generate the described sensory perception for a typical (or average) user.

[0057] It should be appreciated that device 100 is only one example of a portable multifunction device, and that device 100 optionally has more or fewer components than shown, optionally combines two or more components, or optionally has a different configuration or arrangement of the components. The various components shown in Figure 1A are implemented in hardware, software, or a combination of both hardware and software, including one or more signal processing and/or application specific integrated circuits.

[0058] Memory 102 optionally includes high-speed random access memory and optionally also includes non-volatile memory, such as one or more magnetic disk storage devices, flash memory devices, or other non-volatile solid-state memory devices. Access to memory 102 by other components of device 100, such as CPU 120 and the peripherals interface 118, is, optionally, controlled by memory controller 122.

[0059] Peripherals interface 118 can be used to couple input and output peripherals of the device to CPU 120 and memory 102. The one or more processors 120 run or execute various software programs and/or sets of instructions stored in memory 102 to perform various functions for device 100 and to process data.

[0060] In some embodiments, peripherals interface 118, CPU 120, and memory controller 122 are, optionally, implemented on a single chip, such as chip 104. In some other embodiments, they are, optionally, implemented on separate chips.

[0061] RF (radio frequency) circuitry 108 receives and sends RF signals, also called electromagnetic signals. RF circuitry 108 converts electrical signals to/from electromagnetic signals and communicates with communications networks and other communications devices via the electromagnetic signals. RF circuitry 108 optionally includes well-known circuitry for performing these functions, including but not limited to an antenna system, an RF transceiver, one or more amplifiers, a tuner, one or more oscillators, a digital signal processor, a CODEC

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chipset, a subscriber identity module (SIM) card, memory, and so forth. RF circuitry 108 optionally communicates with networks, such as the Internet, also referred to as the World Wide Web (WWW), an intranet and/or a wireless network, such as a cellular telephone network, a wireless local area network (LAN) and/or a metropolitan area network (MAN), and other devices by wireless communication. The wireless communication optionally uses any of a plurality of communications standards, protocols and technologies, including but not limited to Global System for Mobile Communications (GSM), Enhanced Data GSM Environment (EDGE), high-speed downlink packet access (HSDPA), high-speed uplink packet access (HSUPA), Evolution, Data-Only (EV-DO), HSPA, HSPA+, Dual-Cell HSPA (DC-HSPDA), long term evolution (LTE), near field communication (NFC), wideband code division multiple access (W-CDMA), code division multiple access (CDMA), time division multiple access (TDMA), Bluetooth, Wireless Fidelity (Wi-Fi) (e.g., IEEE 802.11a, IEEE 802.11b, IEEE 802.11g and/or IEEE 802.11n), voice over Internet Protocol (VoIP), Wi-MAX, a protocol for e-mail (e.g., Internet message access protocol (IMAP) and/or post office protocol (POP)), instant messaging (e.g., extensible messaging and presence protocol (XMPP), Session Initiation Protocol for Instant Messaging and Presence Leveraging Extensions (SIMPLE), Instant Messaging and Presence Service (IMPS)), and/or Short Message Service (SMS), or any other suitable communication protocol, including communication protocols not yet developed as of the filing date of this document.

[0062] Audio circuitry 110, speaker 111, and microphone 113 provide an audio interface between a user and device 100. Audio circuitry 110 receives audio data from peripherals interface 118, converts the audio data to an electrical signal, and transmits the electrical signal to speaker 111. Speaker 111 converts the electrical signal to human-audible sound waves. Audio circuitry 110 also receives electrical signals converted by microphone 113 from sound waves. Audio circuitry 110 converts the electrical signal to audio data and transmits the audio data to peripherals interface 118 for processing. Audio data is, optionally, retrieved from and/or transmitted to memory 102 and/or RF circuitry 108 by peripherals interface 118. In some embodiments, audio circuitry 110 also includes a headset jack (e.g., 212, Figure 2). The headset jack provides an interface between audio circuitry 110 and removable audio input/output peripherals, such as output-only headphones or a headset with both output (e.g., a headphone for one or both ears) and input (e.g., a microphone).

[0063] I/O subsystem 106 couples input/output peripherals on device 100, such as touch screen 112 and other input control devices 116, to peripherals interface 118. I/O

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subsystem 106 optionally includes display controller 156, optical sensor controller 158, intensity sensor controller 159, haptic feedback controller 161 and one or more input controllers 160 for other input or control devices. The one or more input controllers 160 receive/send electrical signals from/to other input or control devices 116. The other input control devices 116 optionally include physical buttons (e.g., push buttons, rocker buttons, etc.), dials, slider switches, joysticks, click wheels, and so forth. In some alternate embodiments, input controller(s) 160 are, optionally, coupled to any (or none) of the following: a keyboard, infrared port, USB port, and a pointer device such as a mouse. The one or more buttons (e.g., 208, Figure 2) optionally include an up/down button for volume control of speaker 111 and/or microphone 113. The one or more buttons optionally include a push button (e.g., 206, Figure 2).

[0064] Touch-sensitive display 112 provides an input interface and an output interface between the device and a user. Display controller 156 receives and/or sends electrical signals from/to touch screen 112. Touch screen 112 displays visual output to the user. The visual output optionally includes graphics, text, icons, video, and any combination thereof (collectively termed "graphics"). In some embodiments, some or all of the visual output corresponds to user-interface objects.

[0065] Touch screen 112 has a touch-sensitive surface, sensor or set of sensors that accepts input from the user based on haptic and/or tactile contact. Touch screen 112 and display controller 156 (along with any associated modules and/or sets of instructions in memory 102) detect contact (and any movement or breaking of the contact) on touch screen 112 and converts the detected contact into interaction with user-interface objects (e.g., one or more soft keys, icons, web pages or images) that are displayed on touch screen 112. In an exemplary embodiment, a point of contact between touch screen 112 and the user corresponds to a finger of the user.

[0066] Touch screen 112 optionally uses LCD (liquid crystal display) technology, LPD (light emitting polymer display) technology, or LED (light emitting diode) technology, although other display technologies are used in other embodiments. Touch screen 112 and display controller 156 optionally detect contact and any movement or breaking thereof using any of a plurality of touch sensing technologies now known or later developed, including but not limited to capacitive, resistive, infrared, and surface acoustic wave technologies, as well as other proximity sensor arrays or other elements for determining one or more points of contact with touch screen 112. In an exemplary embodiment, projected mutual capacitance

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sensing technology is used, such as that found in the iPhone®, iPod Touch®, and iPad® from Apple Inc. of Cupertino, California.

[0067] Touch screen 112 optionally has a video resolution in excess of 100 dpi. In some embodiments, the touch screen has a video resolution of approximately 160 dpi. The user optionally makes contact with touch screen 112 using any suitable object or appendage, such as a stylus, a finger, and so forth. In some embodiments, the user interface is designed to work primarily with finger-based contacts and gestures, which can be less precise than stylus-based input due to the larger area of contact of a finger on the touch screen. In some embodiments, the device translates the rough finger-based input into a precise pointer/cursor position or command for performing the actions desired by the user.

[0068] In some embodiments, in addition to the touch screen, device 100 optionally includes a touchpad (not shown) for activating or deactivating particular functions. In some embodiments, the touchpad is a touch-sensitive area of the device that, unlike the touch screen, does not display visual output. The touchpad is, optionally, a touch-sensitive surface that is separate from touch screen 112 or an extension of the touch-sensitive surface formed by the touch screen.

[0069] Device 100 also includes power system 162 for powering the various components. Power system 162 optionally includes a power management system, one or more power sources (e.g., battery, alternating current (AC)), a recharging system, a power failure detection circuit, a power converter or inverter, a power status indicator (e.g., a light-emitting diode (LED)) and any other components associated with the generation, management and distribution of power in portable devices.

[0070] Device 100 optionally also includes one or more optical sensors 164. Figure 1A shows an optical sensor coupled to optical sensor controller 158 in I/O subsystem 106. Optical sensor 164 optionally includes charge-coupled device (CCD) or complementary metal-oxide semiconductor (CMOS) phototransistors. Optical sensor 164 receives light from the environment, projected through one or more lens, and converts the light to data representing an image. In conjunction with imaging module 143 (also called a camera module), optical sensor 164 optionally captures still images or video. In some embodiments, an optical sensor is located on the back of device 100, opposite touch screen display 112 on the front of the device, so that the touch screen display is enabled for use as a viewfinder for still and/or video image acquisition. In some embodiments, another optical sensor is located

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on the front of the device so that the user's image is, optionally, obtained for videoconferencing while the user views the other video conference participants on the touch screen display.

[0071] Device 100 optionally also includes one or more contact intensity sensors 165. Figure 1A shows a contact intensity sensor coupled to intensity sensor controller 159 in I/O subsystem 106. Contact intensity sensor 165 optionally includes one or more piezoresistive strain gauges, capacitive force sensors, electric force sensors, piezoelectric force sensors, optical force sensors, capacitive touch-sensitive surfaces, or other intensity sensors (e.g., sensors used to measure the force (or pressure) of a contact on a touch-sensitive surface). Contact intensity sensor 165 receives contact intensity information (e.g., pressure information or a proxy for pressure information) from the environment. In some embodiments, at least one contact intensity sensor is collocated with, or proximate to, a touch-sensitive surface (e.g., touch-sensitive display system 112). In some embodiments, at least one contact intensity sensor is located on the back of device 100, opposite touch screen display 112 which is located on the front of device 100.

[0072] Device 100 optionally also includes one or more proximity sensors 166. Figure 1A shows proximity sensor 166 coupled to peripherals interface 118. Alternately, proximity sensor 166 is coupled to input controller 160 in I/O subsystem 106. In some embodiments, the proximity sensor turns off and disables touch screen 112 when the multifunction device is placed near the user's ear (e.g., when the user is making a phone call).

[0073] Device 100 optionally also includes one or more tactile output generators 167. Figure 1A shows a tactile output generator coupled to haptic feedback controller 161 in I/O subsystem 106. Tactile output generator 167 optionally includes one or more electroacoustic devices such as speakers or other audio components and/or electromechanical devices that convert energy into linear motion such as a motor, solenoid, electroactive polymer, piezoelectric actuator, electrostatic actuator, or other tactile output generating component (e.g., a component that converts electrical signals into tactile outputs on the device). Contact intensity sensor 165 receives tactile feedback generation instructions from haptic feedback module 133 and generates tactile outputs on device 100 that are capable of being sensed by a user of device 100. In some embodiments, at least one tactile output generator is collocated with, or proximate to, a touch-sensitive surface (e.g., touch-sensitive display system 112) and, optionally, generates a tactile output by moving the touch-sensitive surface vertically (e.g., in/out of a surface of device 100) or laterally (e.g., back and forth in the same plane as a

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surface of device 100). In some embodiments, at least one tactile output generator sensor is located on the back of device 100, opposite touch screen display 112 which is located on the front of device 100.

[0074] Device 100 optionally also includes one or more accelerometers 168. Figure 1A shows accelerometer 168 coupled to peripherals interface 118. Alternately, accelerometer 168 is, optionally, coupled to an input controller 160 in I/O subsystem 106. In some embodiments, information is displayed on the touch screen display in a portrait view or a landscape view based on an analysis of data received from the one or more accelerometers. Device 100 optionally includes, in addition to accelerometer(s) 168, a magnetometer (not shown) and a GPS (or GLONASS or other global navigation system) receiver (not shown) for obtaining information concerning the location and orientation (e.g., portrait or landscape) of device 100.

[0075] In some embodiments, the software components stored in memory 102 include operating system 126, communication module (or set of instructions) 128, contact/motion module (or set of instructions) 130, graphics module (or set of instructions) 132, text input module (or set of instructions) 134, Global Positioning System (GPS) module (or set of instructions) 135, and applications (or sets of instructions) 136. Furthermore, in some embodiments memory 102 stores device/global internal state 157, as shown in Figures 1A and 3. Device/global internal state 157 includes one or more of: active application state, indicating which applications, if any, are currently active; display state, indicating what applications, views or other information occupy various regions of touch screen display 112; sensor state, including information obtained from the device's various sensors and input control devices 116; and location information concerning the device's location and/or attitude.

[0076] Operating system 126 (e.g., Darwin, RTXC, LINUX, UNIX, OS X, WINDOWS, or an embedded operating system such as VxWorks) includes various software components and/or drivers for controlling and managing general system tasks (e.g., memory management, storage device control, power management, etc.) and facilitates communication between various hardware and software components.

[0077] Communication module 128 facilitates communication with other devices over one or more external ports 124 and also includes various software components for handling data received by RF circuitry 108 and/or external port 124. External port 124 (e.g.,

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Universal Serial Bus (USB), FIREWIRE, etc.) is adapted for coupling directly to other devices or indirectly over a network (e.g., the Internet, wireless LAN, etc.). In some embodiments, the external port is a multi-pin (e.g., 30-pin) connector that is the same as, or similar to and/or compatible with the 30-pin connector used on iPod (trademark of Apple Inc.) devices.

[0078] Contact/motion module 130 optionally detects contact with touch screen 112 (in conjunction with display controller 156) and other touch sensitive devices (e.g., a touchpad or physical click wheel). Contact/motion module 130 includes various software components for performing various operations related to detection of contact, such as determining if contact has occurred (e.g., detecting a finger-down event), determining an intensity of the contact (e.g., the force or pressure of the contact or a substitute for the force or pressure of the contact) determining if there is movement of the contact and tracking the movement across the touch-sensitive surface (e.g., detecting one or more finger-dragging events), and determining if the contact has ceased (e.g., detecting a finger-up event or a break in contact). Contact/motion module 130 receives contact data from the touch-sensitive surface. Determining movement of the point of contact, which is represented by a series of contact data, optionally includes determining speed (magnitude), velocity (magnitude and direction), and/or an acceleration (a change in magnitude and/or direction) of the point of contact. These operations are, optionally, applied to single contacts (e.g., one finger contacts) or to multiple simultaneous contacts (e.g., "multitouch"/multiple finger contacts). In some embodiments, contact/motion module 130 and display controller 156 detect contact on a touchpad.

[0079] In some embodiments, contact/motion module 130 uses a set of one or more intensity thresholds to determine whether an operation has been performed by a user (e.g., to determine whether a user has “clicked” on an icon). In some embodiments at least a subset of the intensity thresholds are determined in accordance with software parameters (e.g., the intensity thresholds are not determined by the activation thresholds of particular physical actuators and can be adjusted without changing the physical hardware of device 100). For example, a mouse “click” threshold of a trackpad or touch screen display can be set to any of a large range of predefined thresholds values without changing the trackpad or touch screen display hardware. Additionally, in some implementations a user of the device is provided with software settings for adjusting one or more of the set of intensity thresholds (e.g., by

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adjusting individual intensity thresholds and/or by adjusting a plurality of intensity thresholds at once with a system-level click "intensity" parameter).

[0080] Contact/motion module 130 optionally detects a gesture input by a user. Different gestures on the touch-sensitive surface have different contact patterns and intensities. Thus, a gesture is, optionally, detected by detecting a particular contact pattern. For example, detecting a finger tap gesture includes detecting a finger-down event followed by detecting a finger-up (lift off) event at the same position (or substantially the same position) as the finger-down event (e.g., at the position of an icon). As another example, detecting a finger swipe gesture on the touch-sensitive surface includes detecting a finger-down event followed by detecting one or more finger-dragging events, and subsequently followed by detecting a finger-up (lift off) event.

[0081] Graphics module 132 includes various known software components for rendering and displaying graphics on touch screen 112 or other display, including components for changing the visual impact (e.g., brightness, transparency, saturation, contrast or other visual property) of graphics that are displayed. As used herein, the term "graphics" includes any object that can be displayed to a user, including without limitation text, web pages, icons (such as user-interface objects including soft keys), digital images, videos, animations and the like.

[0082] In some embodiments, graphics module 132 stores data representing graphics to be used. Each graphic is, optionally, assigned a corresponding code. Graphics module 132 receives, from applications etc., one or more codes specifying graphics to be displayed along with, if necessary, coordinate data and other graphic property data, and then generates screen image data to output to display controller 156.

[0083] Haptic feedback module 133 includes various software components for generating instructions used by tactile output generator(s) 167 to produce tactile outputs at one or more locations on device 100 in response to user interactions with device 100.

[0084] Text input module 134, which is, optionally, a component of graphics module 132, provides soft keyboards for entering text in various applications (e.g., contacts 137, e-mail 140, IM 141, browser 147, and any other application that needs text input).

[0085] GPS module 135 determines the location of the device and provides this information for use in various applications (e.g., to telephone 138 for use in location-based dialing, to camera 143 as picture/video metadata, and to applications that provide location-

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based services such as weather widgets, local yellow page widgets, and map/navigation widgets).

[0086] Applications 136 optionally include the following modules (or sets of instructions), or a subset or superset thereof:

- contacts module 137 (sometimes called an address book or contact list);
- telephone module 138;
- video conferencing module 139;
- e-mail client module 140;
- instant messaging (IM) module 141;
- workout support module 142;
- camera module 143 for still and/or video images;
- image management module 144;
- browser module 147;
- calendar module 148;
- widget modules 149, which optionally include one or more of: weather widget 149-1, stocks widget 149-2, calculator widget 149-3, alarm clock widget 149-4, dictionary widget 149-5, and other widgets obtained by the user, as well as user-created widgets 149-6;
- widget creator module 150 for making user-created widgets 149-6;
- search module 151;
- video and music player module 152, which is, optionally, made up of a video player module and a music player module;
- notes module 153;
- map module 154; and/or
- online video module 155.

[0087] Examples of other applications 136 that are, optionally, stored in memory 102 include other word processing applications, other image editing applications, drawing

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applications, presentation applications, JAVA-enabled applications, encryption, digital rights management, voice recognition, and voice replication.

[0088] In conjunction with touch screen 112, display controller 156, contact module 130, graphics module 132, and text input module 134, contacts module 137 are, optionally, used to manage an address book or contact list (e.g., stored in application internal state 192 of contacts module 137 in memory 102 or memory 370), including: adding name(s) to the address book; deleting name(s) from the address book; associating telephone number(s), e-mail address(es), physical address(es) or other information with a name; associating an image with a name; categorizing and sorting names; providing telephone numbers or e-mail addresses to initiate and/or facilitate communications by telephone 138, video conference 139, e-mail 140, or IM 141; and so forth.

[0089] In conjunction with RF circuitry 108, audio circuitry 110, speaker 111, microphone 113, touch screen 112, display controller 156, contact module 130, graphics module 132, and text input module 134, telephone module 138 are, optionally, used to enter a sequence of characters corresponding to a telephone number, access one or more telephone numbers in address book 137, modify a telephone number that has been entered, dial a respective telephone number, conduct a conversation and disconnect or hang up when the conversation is completed. As noted above, the wireless communication optionally uses any of a plurality of communications standards, protocols and technologies.

[0090] In conjunction with RF circuitry 108, audio circuitry 110, speaker 111, microphone 113, touch screen 112, display controller 156, optical sensor 164, optical sensor controller 158, contact module 130, graphics module 132, text input module 134, contact list 137, and telephone module 138, videoconferencing module 139 includes executable instructions to initiate, conduct, and terminate a video conference between a user and one or more other participants in accordance with user instructions.

[0091] In conjunction with RF circuitry 108, touch screen 112, display controller 156, contact module 130, graphics module 132, and text input module 134, e-mail client module 140 includes executable instructions to create, send, receive, and manage e-mail in response to user instructions. In conjunction with image management module 144, e-mail client module 140 makes it very easy to create and send e-mails with still or video images taken with camera module 143.

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[0092] In conjunction with RF circuitry 108, touch screen 112, display controller 156, contact module 130, graphics module 132, and text input module 134, the instant messaging module 141 includes executable instructions to enter a sequence of characters corresponding to an instant message, to modify previously entered characters, to transmit a respective instant message (for example, using a Short Message Service (SMS) or Multimedia Message Service (MMS) protocol for telephony-based instant messages or using XMPP, SIMPLE, or IMPS for Internet-based instant messages), to receive instant messages and to view received instant messages. In some embodiments, transmitted and/or received instant messages optionally include graphics, photos, audio files, video files and/or other attachments as are supported in a MMS and/or an Enhanced Messaging Service (EMS). As used herein, "instant messaging" refers to both telephony-based messages (e.g., messages sent using SMS or MMS) and Internet-based messages (e.g., messages sent using XMPP, SIMPLE, or IMPS).

[0093] In conjunction with RF circuitry 108, touch screen 112, display controller 156, contact module 130, graphics module 132, text input module 134, GPS module 135, map module 154, and music player module 146, workout support module 142 includes executable instructions to create workouts (e.g., with time, distance, and/or calorie burning goals); communicate with workout sensors (sports devices); receive workout sensor data; calibrate sensors used to monitor a workout; select and play music for a workout; and display, store and transmit workout data.

[0094] In conjunction with touch screen 112, display controller 156, optical sensor(s) 164, optical sensor controller 158, contact module 130, graphics module 132, and image management module 144, camera module 143 includes executable instructions to capture still images or video (including a video stream) and store them into memory 102, modify characteristics of a still image or video, or delete a still image or video from memory 102.

[0095] In conjunction with touch screen 112, display controller 156, contact module 130, graphics module 132, text input module 134, and camera module 143, image management module 144 includes executable instructions to arrange, modify (e.g., edit), or otherwise manipulate, label, delete, present (e.g., in a digital slide show or album), and store still and/or video images.

[0096] In conjunction with RF circuitry 108, touch screen 112, display system controller 156, contact module 130, graphics module 132, and text input module 134, browser module 147 includes executable instructions to browse the Internet in accordance

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with user instructions, including searching, linking to, receiving, and displaying web pages or portions thereof, as well as attachments and other files linked to web pages.

[0097] In conjunction with RF circuitry 108, touch screen 112, display system controller 156, contact module 130, graphics module 132, text input module 134, e-mail client module 140, and browser module 147, calendar module 148 includes executable instructions to create, display, modify, and store calendars and data associated with calendars (e.g., calendar entries, to do lists, etc.) in accordance with user instructions.

[0098] In conjunction with RF circuitry 108, touch screen 112, display system controller 156, contact module 130, graphics module 132, text input module 134, and browser module 147, widget modules 149 are mini-applications that are, optionally, downloaded and used by a user (e.g., weather widget 149-1, stocks widget 149-2, calculator widget 149-3, alarm clock widget 149-4, and dictionary widget 149-5) or created by the user (e.g., user-created widget 149-6). In some embodiments, a widget includes an HTML (Hypertext Markup Language) file, a CSS (Cascading Style Sheets) file, and a JavaScript file. In some embodiments, a widget includes an XML (Extensible Markup Language) file and a JavaScript file (e.g., Yahoo! Widgets).

[0099] In conjunction with RF circuitry 108, touch screen 112, display system controller 156, contact module 130, graphics module 132, text input module 134, and browser module 147, the widget creator module 150 are, optionally, used by a user to create widgets (e.g., turning a user-specified portion of a web page into a widget).

[00100] In conjunction with touch screen 112, display system controller 156, contact module 130, graphics module 132, and text input module 134, search module 151 includes executable instructions to search for text, music, sound, image, video, and/or other files in memory 102 that match one or more search criteria (e.g., one or more user-specified search terms) in accordance with user instructions.

[00101] In conjunction with touch screen 112, display system controller 156, contact module 130, graphics module 132, audio circuitry 110, speaker 111, RF circuitry 108, and browser module 147, video and music player module 152 includes executable instructions that allow the user to download and play back recorded music and other sound files stored in one or more file formats, such as MP3 or AAC files, and executable instructions to display, present or otherwise play back videos (e.g., on touch screen 112 or on an external, connected

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display via external port 124). In some embodiments, device 100 optionally includes the functionality of an MP3 player, such as an iPod (trademark of Apple Inc.).

[00102] In conjunction with touch screen 112, display controller 156, contact module 130, graphics module 132, and text input module 134, notes module 153 includes executable instructions to create and manage notes, to do lists, and the like in accordance with user instructions.

[00103] In conjunction with RF circuitry 108, touch screen 112, display system controller 156, contact module 130, graphics module 132, text input module 134, GPS module 135, and browser module 147, map module 154 are, optionally, used to receive, display, modify, and store maps and data associated with maps (e.g., driving directions; data on stores and other points of interest at or near a particular location; and other location-based data) in accordance with user instructions.

[00104] In conjunction with touch screen 112, display system controller 156, contact module 130, graphics module 132, audio circuitry 110, speaker 111, RF circuitry 108, text input module 134, e-mail client module 140, and browser module 147, online video module 155 includes instructions that allow the user to access, browse, receive (e.g., by streaming and/or download), play back (e.g., on the touch screen or on an external, connected display via external port 124), send an e-mail with a link to a particular online video, and otherwise manage online videos in one or more file formats, such as H.264. In some embodiments, instant messaging module 141, rather than e-mail client module 140, is used to send a link to a particular online video.

[00105] Each of the above identified modules and applications correspond to a set of executable instructions for performing one or more functions described above and the methods described in this application (e.g., the computer-implemented methods and other information processing methods described herein). These modules (i.e., sets of instructions) need not be implemented as separate software programs, procedures or modules, and thus various subsets of these modules are, optionally, combined or otherwise re-arranged in various embodiments. In some embodiments, memory 102 optionally stores a subset of the modules and data structures identified above. Furthermore, memory 102 optionally stores additional modules and data structures not described above.

[00106] In some embodiments, device 100 is a device where operation of a predefined set of functions on the device is performed exclusively through a touch screen and/or a

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touchpad. By using a touch screen and/or a touchpad as the primary input control device for operation of device 100, the number of physical input control devices (such as push buttons, dials, and the like) on device 100 is, optionally, reduced.

[00107] The predefined set of functions that are performed exclusively through a touch screen and/or a touchpad optionally include navigation between user interfaces. In some embodiments, the touchpad, when touched by the user, navigates device 100 to a main, home, or root menu from any user interface that is displayed on device 100. In such embodiments, a "menu button" is implemented using a touchpad. In some other embodiments, the menu button is a physical push button or other physical input control device instead of a touchpad.

[00108] Figure 1B is a block diagram illustrating exemplary components for event handling in accordance with some embodiments. In some embodiments, memory 102 (in Figures 1A) or 370 (Figure 3) includes event sorter 170 (e.g., in operating system 126) and a respective application 136-1 (e.g., any of the aforementioned applications 137-151, 155, 380-390).

[00109] Event sorter 170 receives event information and determines the application 136-1 and application view 191 of application 136-1 to which to deliver the event information. Event sorter 170 includes event monitor 171 and event dispatcher module 174. In some embodiments, application 136-1 includes application internal state 192, which indicates the current application view(s) displayed on touch sensitive display 112 when the application is active or executing. In some embodiments, device/global internal state 157 is used by event sorter 170 to determine which application(s) is (are) currently active, and application internal state 192 is used by event sorter 170 to determine application views 191 to which to deliver event information.

[00110] In some embodiments, application internal state 192 includes additional information, such as one or more of: resume information to be used when application 136-1 resumes execution, user interface state information that indicates information being displayed or that is ready for display by application 136-1, a state queue for enabling the user to go back to a prior state or view of application 136-1, and a redo/undo queue of previous actions taken by the user.

[00111] Event monitor 171 receives event information from peripherals interface 118. Event information includes information about a sub-event (e.g., a user touch on touch-sensitive display 112, as part of a multi-touch gesture). Peripherals interface 118 transmits

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information it receives from I/O subsystem 106 or a sensor, such as proximity sensor 166, accelerometer(s) 168, and/or microphone 113 (through audio circuitry 110). Information that peripherals interface 118 receives from I/O subsystem 106 includes information from touch-sensitive display 112 or a touch-sensitive surface.

[00112] In some embodiments, event monitor 171 sends requests to the peripherals interface 118 at predetermined intervals. In response, peripherals interface 118 transmits event information. In other embodiments, peripheral interface 118 transmits event information only when there is a significant event (e.g., receiving an input above a predetermined noise threshold and/or for more than a predetermined duration).

[00113] In some embodiments, event sorter 170 also includes a hit view determination module 172 and/or an active event recognizer determination module 173.

[00114] Hit view determination module 172 provides software procedures for determining where a sub-event has taken place within one or more views, when touch sensitive display 112 displays more than one view. Views are made up of controls and other elements that a user can see on the display.

[00115] Another aspect of the user interface associated with an application is a set of views, sometimes herein called application views or user interface windows, in which information is displayed and touch-based gestures occur. The application views (of a respective application) in which a touch is detected optionally correspond to programmatic levels within a programmatic or view hierarchy of the application. For example, the lowest level view in which a touch is detected is, optionally, called the hit view, and the set of events that are recognized as proper inputs are, optionally, determined based, at least in part, on the hit view of the initial touch that begins a touch-based gesture.

[00116] Hit view determination module 172 receives information related to sub-events of a touch-based gesture. When an application has multiple views organized in a hierarchy, hit view determination module 172 identifies a hit view as the lowest view in the hierarchy which should handle the sub-event. In most circumstances, the hit view is the lowest level view in which an initiating sub-event occurs (i.e., the first sub-event in the sequence of sub-events that form an event or potential event). Once the hit view is identified by the hit view determination module, the hit view typically receives all sub-events related to the same touch or input source for which it was identified as the hit view.

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[00117] Active event recognizer determination module 173 determines which view or views within a view hierarchy should receive a particular sequence of sub-events. In some embodiments, active event recognizer determination module 173 determines that only the hit view should receive a particular sequence of sub-events. In other embodiments, active event recognizer determination module 173 determines that all views that include the physical location of a sub-event are actively involved views, and therefore determines that all actively involved views should receive a particular sequence of sub-events. In other embodiments, even if touch sub-events were entirely confined to the area associated with one particular view, views higher in the hierarchy would still remain as actively involved views.

[00118] Event dispatcher module 174 dispatches the event information to an event recognizer (e.g., event recognizer 180). In embodiments including active event recognizer determination module 173, event dispatcher module 174 delivers the event information to an event recognizer determined by active event recognizer determination module 173. In some embodiments, event dispatcher module 174 stores in an event queue the event information, which is retrieved by a respective event receiver module 182.

[00119] In some embodiments, operating system 126 includes event sorter 170. Alternatively, application 136-1 includes event sorter 170. In yet other embodiments, event sorter 170 is a stand-alone module, or a part of another module stored in memory 102, such as contact/motion module 130.

[00120] In some embodiments, application 136-1 includes a plurality of event handlers 190 and one or more application views 191, each of which includes instructions for handling touch events that occur within a respective view of the application's user interface. Each application view 191 of the application 136-1 includes one or more event recognizers 180. Typically, a respective application view 191 includes a plurality of event recognizers 180. In other embodiments, one or more of event recognizers 180 are part of a separate module, such as a user interface kit (not shown) or a higher level object from which application 136-1 inherits methods and other properties. In some embodiments, a respective event handler 190 includes one or more of: data updater 176, object updater 177, GUI updater 178, and/or event data 179 received from event sorter 170. Event handler 190 optionally utilizes or calls data updater 176, object updater 177 or GUI updater 178 to update the application internal state 192. Alternatively, one or more of the application views 191 includes one or more respective event handlers 190. Also, in some embodiments, one or more of data updater 176, object updater 177, and GUI updater 178 are included in a respective application view 191.

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[00121] A respective event recognizer 180 receives event information (e.g., event data 179) from event sorter 170, and identifies an event from the event information. Event recognizer 180 includes event receiver 182 and event comparator 184. In some embodiments, event recognizer 180 also includes at least a subset of: metadata 183, and event delivery instructions 188 (which optionally include sub-event delivery instructions).

[00122] Event receiver 182 receives event information from event sorter 170. The event information includes information about a sub-event, for example, a touch or a touch movement. Depending on the sub-event, the event information also includes additional information, such as location of the sub-event. When the sub-event concerns motion of a touch, the event information optionally also includes speed and direction of the sub-event. In some embodiments, events include rotation of the device from one orientation to another (e.g., from a portrait orientation to a landscape orientation, or vice versa), and the event information includes corresponding information about the current orientation (also called device attitude) of the device.

[00123] Event comparator 184 compares the event information to predefined event or sub-event definitions and, based on the comparison, determines an event or sub-event, or determines or updates the state of an event or sub-event. In some embodiments, event comparator 184 includes event definitions 186. Event definitions 186 contain definitions of events (e.g., predefined sequences of sub-events), for example, event 1 (187-1), event 2 (187-2), and others. In some embodiments, sub-events in an event 187 include, for example, touch begin, touch end, touch movement, touch cancellation, and multiple touching. In one example, the definition for event 1 (187-1) is a double tap on a displayed object. The double tap, for example, comprises a first touch (touch begin) on the displayed object for a predetermined phase, a first lift-off (touch end) for a predetermined phase, a second touch (touch begin) on the displayed object for a predetermined phase, and a second lift-off (touch end) for a predetermined phase. In another example, the definition for event 2 (187-2) is a dragging on a displayed object. The dragging, for example, comprises a touch (or contact) on the displayed object for a predetermined phase, a movement of the touch across touch-sensitive display 112, and lift-off of the touch (touch end). In some embodiments, the event also includes information for one or more associated event handlers 190.

[00124] In some embodiments, event definition 187 includes a definition of an event for a respective user-interface object. In some embodiments, event comparator 184 performs a hit test to determine which user-interface object is associated with a sub-event. For

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example, in an application view in which three user-interface objects are displayed on touch-sensitive display 112, when a touch is detected on touch-sensitive display 112, event comparator 184 performs a hit test to determine which of the three user-interface objects is associated with the touch (sub-event). If each displayed object is associated with a respective event handler 190, the event comparator uses the result of the hit test to determine which event handler 190 should be activated. For example, event comparator 184 selects an event handler associated with the sub-event and the object triggering the hit test.

[00125] In some embodiments, the definition for a respective event 187 also includes delayed actions that delay delivery of the event information until after it has been determined whether the sequence of sub-events does or does not correspond to the event recognizer's event type.

[00126] When a respective event recognizer 180 determines that the series of sub-events do not match any of the events in event definitions 186, the respective event recognizer 180 enters an event impossible, event failed, or event ended state, after which it disregards subsequent sub-events of the touch-based gesture. In this situation, other event recognizers, if any, that remain active for the hit view continue to track and process sub-events of an ongoing touch-based gesture.

[00127] In some embodiments, a respective event recognizer 180 includes metadata 183 with configurable properties, flags, and/or lists that indicate how the event delivery system should perform sub-event delivery to actively involved event recognizers. In some embodiments, metadata 183 includes configurable properties, flags, and/or lists that indicate how event recognizers interact, or are enabled to interact, with one another. In some embodiments, metadata 183 includes configurable properties, flags, and/or lists that indicate whether sub-events are delivered to varying levels in the view or programmatic hierarchy.

[00128] In some embodiments, a respective event recognizer 180 activates event handler 190 associated with an event when one or more particular sub-events of an event are recognized. In some embodiments, a respective event recognizer 180 delivers event information associated with the event to event handler 190. Activating an event handler 190 is distinct from sending (and deferred sending) sub-events to a respective hit view. In some embodiments, event recognizer 180 throws a flag associated with the recognized event, and event handler 190 associated with the flag catches the flag and performs a predefined process.

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[00129] In some embodiments, event delivery instructions 188 include sub-event delivery instructions that deliver event information about a sub-event without activating an event handler. Instead, the sub-event delivery instructions deliver event information to event handlers associated with the series of sub-events or to actively involved views. Event handlers associated with the series of sub-events or with actively involved views receive the event information and perform a predetermined process.

[00130] In some embodiments, data updater 176 creates and updates data used in application 136-1. For example, data updater 176 updates the telephone number used in contacts module 137, or stores a video file used in video player module 145. In some embodiments, object updater 177 creates and updates objects used in application 136-1. For example, object updater 176 creates a new user-interface object or updates the position of a user-interface object. GUI updater 178 updates the GUI. For example, GUI updater 178 prepares display information and sends it to graphics module 132 for display on a touch-sensitive display.

[00131] In some embodiments, event handler(s) 190 includes or has access to data updater 176, object updater 177, and GUI updater 178. In some embodiments, data updater 176, object updater 177, and GUI updater 178 are included in a single module of a respective application 136-1 or application view 191. In other embodiments, they are included in two or more software modules.

[00132] It shall be understood that the foregoing discussion regarding event handling of user touches on touch-sensitive displays also applies to other forms of user inputs to operate multifunction devices 100 with input-devices, not all of which are initiated on touch screens. For example, mouse movement and mouse button presses, optionally coordinated with single or multiple keyboard presses or holds; contact movements such as taps, drags, scrolls, etc., on touch-pads; pen stylus inputs; movement of the device; oral instructions; detected eye movements; biometric inputs; and/or any combination thereof are optionally utilized as inputs corresponding to sub-events which define an event to be recognized.

[00133] Figure 2 illustrates a portable multifunction device 100 having a touch screen 112 in accordance with some embodiments. The touch screen optionally displays one or more graphics within user interface (UI) 200. In this embodiment, as well as others described below, a user is enabled to select one or more of the graphics by making a gesture on the graphics, for example, with one or more fingers 202 (not drawn to scale in the figure) or one

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or more styluses 203 (not drawn to scale in the figure). In some embodiments, selection of one or more graphics occurs when the user breaks contact with the one or more graphics. In some embodiments, the gesture optionally includes one or more taps, one or more swipes (from left to right, right to left, upward and/or downward) and/or a rolling of a finger (from right to left, left to right, upward and/or downward) that has made contact with device 100. In some implementations or circumstances, inadvertent contact with a graphic does not select the graphic. For example, a swipe gesture that sweeps over an application icon optionally does not select the corresponding application when the gesture corresponding to selection is a tap.

[00134] Device 100 optionally also includes one or more physical buttons, such as "home" or menu button 204. As described previously, menu button 204 is, optionally, used to navigate to any application 136 in a set of applications that are, optionally executed on device 100. Alternatively, in some embodiments, the menu button is implemented as a soft key in a GUI displayed on touch screen 112.

[00135] In one embodiment, device 100 includes touch screen 112, menu button 204, push button 206 for powering the device on/off and locking the device, volume adjustment button(s) 208, Subscriber Identity Module (SIM) card slot 210, head set jack 212, and docking/charging external port 124. Push button 206 is, optionally, used to turn the power on/off on the device by depressing the button and holding the button in the depressed state for a predefined time interval; to lock the device by depressing the button and releasing the button before the predefined time interval has elapsed; and/or to unlock the device or initiate an unlock process. In an alternative embodiment, device 100 also accepts verbal input for activation or deactivation of some functions through microphone 113. Device 100 also, optionally, includes one or more contact intensity sensors 165 for detecting intensity of contacts on touch screen 112 and/or one or more tactile output generators 167 for generating tactile outputs for a user of device 100.

[00136] Figure 3 is a block diagram of an exemplary multifunction device with a display and a touch-sensitive surface in accordance with some embodiments. Device 300 need not be portable. In some embodiments, device 300 is a laptop computer, a desktop computer, a tablet computer, a multimedia player device, a navigation device, an educational device (such as a child's learning toy), a gaming system, or a control device (e.g., a home or industrial controller). Device 300 typically includes one or more processing units (CPU's) 310, one or more network or other communications interfaces 360, memory 370, and one or

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more communication buses 320 for interconnecting these components. Communication buses 320 optionally include circuitry (sometimes called a chipset) that interconnects and controls communications between system components. Device 300 includes input/output (I/O) interface 330 comprising display 340, which is typically a touch screen display. I/O interface 330 also optionally includes a keyboard and/or mouse (or other pointing device) 350 and touchpad 355, tactile output generator 357 for generating tactile outputs on device 300 (e.g., similar to tactile output generator(s) 167 described above with reference to Figure 1A), sensors 359 (e.g., optical, acceleration, proximity, touch-sensitive, and/or contact intensity sensors similar to contact intensity sensor(s) 165 described above with reference to Figure 1A). Memory 370 includes high-speed random access memory, such as DRAM, SRAM, DDR RAM or other random access solid state memory devices; and optionally includes non-volatile memory, such as one or more magnetic disk storage devices, optical disk storage devices, flash memory devices, or other non-volatile solid state storage devices. Memory 370 optionally includes one or more storage devices remotely located from CPU(s) 310. In some embodiments, memory 370 stores programs, modules, and data structures analogous to the programs, modules, and data structures stored in memory 102 of portable multifunction device 100 (Figure 1A), or a subset thereof. Furthermore, memory 370 optionally stores additional programs, modules, and data structures not present in memory 102 of portable multifunction device 100. For example, memory 370 of device 300 optionally stores drawing module 380, presentation module 382, word processing module 384, website creation module 386, disk authoring module 388, and/or spreadsheet module 390, while memory 102 of portable multifunction device 100 (Figure 1A) optionally does not store these modules.

[00137] Each of the above identified elements in Figure 3 are, optionally, stored in one or more of the previously mentioned memory devices. Each of the above identified modules corresponds to a set of instructions for performing a function described above. The above identified modules or programs (i.e., sets of instructions) need not be implemented as separate software programs, procedures or modules, and thus various subsets of these modules are, optionally, combined or otherwise re-arranged in various embodiments. In some embodiments, memory 370 optionally stores a subset of the modules and data structures identified above. Furthermore, memory 370 optionally stores additional modules and data structures not described above.

[00138] Attention is now directed towards embodiments of user interfaces ("UI") that is, optionally, implemented on portable multifunction device 100.

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[00139] Figure 4A illustrates an exemplary user interface for a menu of applications on portable multifunction device 100 in accordance with some embodiments. Similar user interfaces are, optionally, implemented on device 300. In some embodiments, user interface 400 includes the following elements, or a subset or superset thereof:

- Signal strength indicator(s) 402 for wireless communication(s), such as cellular and Wi-Fi signals;
- Time 404;
- Bluetooth indicator 405;
- Battery status indicator 406;
- Tray 408 with icons for frequently used applications, such as:
    - Icon 416 for telephone module 138, labeled "Phone," which optionally includes an indicator 414 of the number of missed calls or voicemail messages;
    - Icon 418 for e-mail client module 140, labeled "Mail," which optionally includes an indicator 410 of the number of unread e-mails;
    - Icon 420 for browser module 147, labeled "Browser;" and
    - Icon 422 for video and music player module 152, also referred to as iPod (trademark of Apple Inc.) module 152, labeled "iPod;" and
- Icons for other applications, such as:
    - Icon 424 for IM module 141, labeled "Text;"
    - Icon 426 for calendar module 148, labeled "Calendar;"
    - Icon 428 for image management module 144, labeled "Photos;"
    - Icon 430 for camera module 143, labeled "Camera;"
    - Icon 432 for online video module 155, labeled "Online Video"
    - Icon 434 for stocks widget 149-2, labeled "Stocks;"
    - Icon 436 for map module 154, labeled "Map;"
    - Icon 438 for weather widget 149-1, labeled "Weather;"
    - Icon 440 for alarm clock widget 149-4, labeled "Clock;"

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- Icon 442 for workout support module 142, labeled "Workout Support;"
- Icon 444 for notes module 153, labeled "Notes;" and
- Icon 446 for a settings application or module, which provides access to settings for device 100 and its various applications 136.

[00140] It should be noted that the icon labels illustrated in Figure 4A are merely exemplary. For example, icon 422 for video and music player module 152 are labeled "Music" or "Music Player." Other labels are, optionally, used for various application icons. In some embodiments, a label for a respective application icon includes a name of an application corresponding to the respective application icon. In some embodiments, a label for a particular application icon is distinct from a name of an application corresponding to the particular application icon.

[00141] Figure 4B illustrates an exemplary user interface on a device (e.g., device 300, Figure 3) with a touch-sensitive surface 451 (e.g., a tablet or touchpad 355, Figure 3) that is separate from the display 450 (e.g., touch screen display 112). Device 300 also, optionally, includes one or more contact intensity sensors (e.g., one or more of sensors 357) for detecting intensity of contacts on touch-sensitive surface 451 and/or one or more tactile output generators 359 for generating tactile outputs for a user of device 300.

[00142] Although some of the examples which follow will be given with reference to inputs on touch screen display 112 (where the touch sensitive surface and the display are combined), in some embodiments, the device detects inputs on a touch-sensitive surface that is separate from the display, as shown in Figure 4B. In some embodiments the touch sensitive surface (e.g., 451 in Figure 4B) has a primary axis (e.g., 452 in Figure 4B) that corresponds to a primary axis (e.g., 453 in Figure 4B) on the display (e.g., 450). In accordance with these embodiments, the device detects contacts (e.g., 460 and 462 in Figure 4B) with the touch-sensitive surface 451 at locations that correspond to respective locations on the display (e.g., in Figure 4B, 460 corresponds to 468 and 462 corresponds to 470). In this way, user inputs (e.g., contacts 460 and 462, and movements thereof) detected by the device on the touch-sensitive surface (e.g., 451 in Figure 4B) are used by the device to manipulate the user interface on the display (e.g., 450 in Figure 4B) of the multifunction device when the touch-sensitive surface is separate from the display. It should be understood that similar methods are, optionally, used for other user interfaces described herein.

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[00143] Additionally, while the following examples are given primarily with reference to finger inputs (e.g., finger contacts, finger tap gestures, finger swipe gestures), it should be understood that, in some embodiments, one or more of the finger inputs are replaced with input from another input device (e.g., a mouse based input or stylus input). For example, a swipe gesture is, optionally, replaced with a mouse click (e.g., instead of a contact) followed by movement of the cursor along the path of the swipe (e.g., instead of movement of the contact). As another example, a tap gesture is, optionally, replaced with a mouse click while the cursor is located over the location of the tap gesture (e.g., instead of detection of the contact followed by ceasing to detect the contact). Similarly, when multiple user inputs are simultaneously detected, it should be understood that multiple computer mice are, optionally, used simultaneously, or a mouse and finger contacts are, optionally, used simultaneously.

[00144] As used herein, the term "focus selector" refers to an input element that indicates a current part of a user interface with which a user is interacting. In some implementations that include a cursor or other location marker, the cursor acts as a "focus selector," so that when an input (e.g., a press input) is detected on a touch-sensitive surface (e.g., touchpad 355 in Figure 3 or touch-sensitive surface 451 in Figure 4B) while the cursor is over a particular user interface element (e.g., a button, window, slider or other user interface element), the particular user interface element is adjusted in accordance with the detected input. In some implementations that include a touch-screen display (e.g., touch-sensitive display system 112 in Figure 1A or touch screen 112 in Figure 4A) that enables direct interaction with user interface elements on the touch-screen display, a detected contact on the touch-screen acts as a "focus selector," so that when an input (e.g., a press input by the contact) is detected on the touch-screen display at a location of a particular user interface element (e.g., a button, window, slider or other user interface element), the particular user interface element is adjusted in accordance with the detected input. In some implementations focus is moved from one region of a user interface to another region of the user interface without corresponding movement of a cursor or movement of a contact on a touch-screen display (e.g., by using a tab key or arrow keys to move focus from one button to another button); in these implementations, the focus selector moves in accordance with movement of focus between different regions of the user interface. Without regard to the specific form taken by the focus selector, the focus selector is generally the user interface element (or contact on a touch-screen display) that is controlled by the user so as to communicate the user's intended interaction with the user interface (e.g., by indicating, to the device, the

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element of the user interface with which the user is intending to interact). For example, the location of a focus selector (e.g., a cursor, a contact or a selection box) over a respective button while a press input is detected on the touch-sensitive surface (e.g., a touchpad or touch screen) will indicate that the user is intending to activate the respective button (as opposed to other user interface elements shown on a display of the device).

[00145] The user interface figures described below include various intensity diagrams that show the current intensity of the contact on the touch-sensitive surface relative to one or more intensity thresholds (e.g., a contact detection intensity threshold IT_0, a light press intensity threshold IT_L, a deep press intensity threshold IT_D, and/or one or more other intensity thresholds). This intensity diagram is typically not part of the displayed user interface, but is provided to aid in the interpretation of the figures. In some embodiments, the light press intensity threshold corresponds to an intensity at which the device will perform operations typically associated with clicking a button of a physical mouse or a trackpad. In some embodiments, the deep press intensity threshold corresponds to an intensity at which the device will perform operations that are different from operations typically associated with clicking a button of a physical mouse or a trackpad. In some embodiments, when a contact is detected with an intensity below the light press intensity threshold (e.g., and above a nominal contact-detection intensity threshold IT_0 below which the contact is no longer detected), the device will move a focus selector in accordance with movement of the contact on the touch-sensitive surface without performing an operation associated with the light press intensity threshold or the deep press intensity threshold. Generally, unless otherwise stated, these intensity thresholds are consistent between different sets of user interface figures.

[00146] An increase of intensity of the contact from an intensity below the light press intensity threshold IT_L to an intensity between the light press intensity threshold IT_L and the deep press intensity threshold IT_D is sometimes referred to as a "light press" input. An increase of intensity of the contact from an intensity below the deep press intensity threshold IT_D to an intensity above the deep press intensity threshold IT_D is sometimes referred to as a "deep press" input. An increase of intensity of the contact from an intensity below the contact-detection intensity threshold IT_0 to an intensity between the contact-detection intensity threshold IT_0 and the light press intensity threshold IT_L is sometimes referred to as detecting the contact on the touch-surface. A decrease of intensity of the contact from an intensity above the contact-detection intensity threshold IT_0 to an intensity below the contact intensity threshold IT_0 is sometimes referred to as detecting liftoff of the contact from the

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touch-surface. In some embodiments IT_0 is zero. In some embodiments IT_0 is greater than zero. In some illustrations a shaded circle or oval is used to represent intensity of a contact on the touch-sensitive surface. In some illustrations a circle or oval without shading is used represent a respective contact on the touch-sensitive surface without specifying the intensity of the respective contact.

[00147] In some embodiments described herein, one or more operations are performed in response to detecting a gesture that includes a respective press input or in response to detecting the respective press input performed with a respective contact (or a plurality of contacts), where the respective press input is detected based at least in part on detecting an increase in intensity of the contact (or plurality of contacts) above a press-input intensity threshold. In some embodiments, the respective operation is performed in response to detecting the increase in intensity of the respective contact above the press-input intensity threshold (e.g., a "down stroke" of the respective press input). In some embodiments, the press input includes an increase in intensity of the respective contact above the press-input intensity threshold and a subsequent decrease in intensity of the contact below the press-input intensity threshold, and the respective operation is performed in response to detecting the subsequent decrease in intensity of the respective contact below the press-input threshold (e.g., an "up stroke" of the respective press input).

[00148] In some embodiments, the device employs intensity hysteresis to avoid accidental inputs sometimes termed "jitter," where the device defines or selects a hysteresis intensity threshold with a predefined relationship to the press-input intensity threshold (e.g., the hysteresis intensity threshold is X intensity units lower than the press-input intensity threshold or the hysteresis intensity threshold is 75%, 90% or some reasonable proportion of the press-input intensity threshold). Thus, in some embodiments, the press input includes an increase in intensity of the respective contact above the press-input intensity threshold and a subsequent decrease in intensity of the contact below the hysteresis intensity threshold that corresponds to the press-input intensity threshold, and the respective operation is performed in response to detecting the subsequent decrease in intensity of the respective contact below the hysteresis intensity threshold (e.g., an "up stroke" of the respective press input). Similarly, in some embodiments, the press input is detected only when the device detects an increase in intensity of the contact from an intensity at or below the hysteresis intensity threshold to an intensity at or above the press-input intensity threshold and, optionally, a subsequent decrease in intensity of the contact to an intensity at or below the hysteresis

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intensity, and the respective operation is performed in response to detecting the press input (e.g., the increase in intensity of the contact or the decrease in intensity of the contact, depending on the circumstances).

[00149] For ease of explanation, the description of operations performed in response to a press input associated with a press-input intensity threshold or in response to a gesture including the press input are, optionally, triggered in response to detecting either: an increase in intensity of a contact above the press-input intensity threshold, an increase in intensity of a contact from an intensity below the hysteresis intensity threshold to an intensity above the press-input intensity threshold, a decrease in intensity of the contact below the press-input intensity threshold, and/or a decrease in intensity of the contact below the hysteresis intensity threshold corresponding to the press-input intensity threshold. Additionally, in examples where an operation is described as being performed in response to detecting a decrease in intensity of a contact below the press-input intensity threshold, the operation is, optionally, performed in response to detecting a decrease in intensity of the contact below a hysteresis intensity threshold corresponding to, and lower than, the press-input intensity threshold.

USER INTERFACES AND ASSOCIATED PROCESSES

Assigning Respective Portions of an Aggregate Intensity to a Plurality of Contacts

[00150] Many electronic devices sense a pressure of a user input. For example, a device with a pressure sensitive button determines an amount that the button is depressed by the user based on a pressure measurement of a pressure sensor integrated with the button. However, such methods do not provide a way to estimate the intensity of multiple different simultaneously detected contacts and thus do not provide a way to interact with an intensity sensitive user interface with multiple contacts. The device improves on these methods by assigning a first portion of an aggregate intensity (e.g., a sum of intensity measurements received from each intensity sensor of a plurality of intensity sensors) of a plurality of contacts on a touch-sensitive surface to a first contact of the plurality of contacts and by assigning a second portion of the aggregate intensity to a second contact of the plurality of contacts, while detecting the plurality of contacts on the touch-sensitive surface. The device assigns the aggregate intensity to the plurality of contacts based at least in part on: a first intensity measurement received from a first intensity sensor of the plurality of intensity sensors; a second intensity measurement from a second intensity sensor of the plurality of intensity sensors; a location of the first intensity sensor relative to the touch-sensitive surface;

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a location of the second intensity sensor relative to the touch-sensitive surface; and a comparison between values of a set of one or more properties of the first contact (e.g., the location of the first contact relative to a center of force) and corresponding values of the set of one or more properties of the second contact , thereby enabling the device to estimate intensity of multiple simultaneously detected contacts and use this information to control convenient and efficient user interfaces.

[00151] Figures 5A-5L illustrate exemplary user interfaces and contacts with a touch-sensitive surface that are assigned respective portions of an aggregate intensity to a plurality of contacts in accordance with some embodiments. The depictions in these figures are used to illustrate the processes described below, including the processes in Figures 6A-6C. Figures 5B and 5H-5K include intensity diagrams that show the current intensity measurements of the intensity sensors relative to units of intensity. Figures 5F and 5H-5J include intensity diagrams that show the current intensities of a plurality of contacts on the touch-sensitive surface relative to units of intensity.

[00152] In some implementations, the intensity assigned to a respective contact is compared with one or more of a plurality of distinct intensity thresholds, for example one or more of a contact detection intensity threshold, "IT_0," a light press intensity threshold, "IT_L," and a deep press intensity threshold, "IT_D," and then one or more operations are performed in accordance with a result of the comparison as described in greater detail with respect to other methods described herein (e.g., those listed in paragraph [0045]).

[00153] In some embodiments, the device is an electronic device with a separate display (e.g., display 450) and a separate touch-sensitive surface (e.g., touch-sensitive surface 451). In some embodiments, the device is portable multifunction device 100, the display is touch-sensitive display system 112, and the touch-sensitive surface includes tactile output generators 167 on the display (Figure 1A). For convenience of explanation, the embodiments described with reference to Figures 5A-5L and 6A-6C will be discussed with reference to display 450 and a separate touch-sensitive surface 451; however, analogous operations are, optionally, performed on a device with a touch-sensitive display system 112 in response to detecting the contacts described in Figures 5A-5L on the touch-sensitive display system 112 while displaying the user interfaces shown in Figures 5A-5L on the touch-sensitive display system 112. In some implementations, a focus selector is, optionally: a respective contact, a representative point corresponding to a contact (e.g., a centroid of a respective contact or a

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point associated with a respective contact), or a centroid or center of force of two or more contacts detected on the touch-sensitive display system 112.

[00154] Figure 5A illustrates a touch-sensitive surface 451 with a plurality of intensity sensors 12902. In some implementations, touch-sensitive surface 451 has four or more intensity sensors 12902. In this example, each of the plurality of intensity sensors 12902 (e.g., four intensity sensors) are positioned in a respective corner of touch-sensitive surface 451.

[00155] Figure 5B illustrates detecting a plurality of contacts 12904 on touch-sensitive surface 451. In this example, the number of contacts (e.g., five contacts 12904) detected on touch-sensitive surface 451 is greater than the number of intensity sensors (e.g., four intensity sensors 12902). In some embodiments, a count of the detected contacts (e.g., five in Figure 5B) is greater than a count of the intensity sensor units (e.g., four in Figure 5B). Figure 5B further illustrates respective intensity measurements of each intensity sensor 12902 (e.g., a measurement of the pressure registered at each sensor) while the plurality of contacts 12904 is detected on touch-sensitive surface 451. In this example, the intensity measurements of intensity sensors 12902-1 and 12902-4 are each 9 units of intensity, and the intensity measurements of intensity sensors 12902-2 and 12902-3 are each 7 units of intensity. Furthermore, in some implementations, an aggregate intensity is the sum of the intensity measurements of a plurality of intensity sensors 12902, which in this example is 32 intensity units. The arrangement of contacts 12904 in Figures 5B-5I is not necessarily a typical of human-user inputs.

[00156] Figure 5C illustrates determining a center of force 12906 on touch-sensitive surface 451 based at least in part on a location of the intensity sensors 12902 relative to touch-sensitive surface 451(e.g., each intensity sensor 12902 is positioned in a respective corner of touch-sensitive surface 451) and the intensity measurements of intensity sensors 12902 (e.g., the intensity measurements of intensity sensors 12902 in Figure 5B). In some implementations, x and y components of the center of force 12906 are determined using predefined mathematical functions, such as $x = \alpha(Bx - Ax)/(Bx + Ax)$ and $y = \beta(Dy - Cy)/(Dy + Cy)$ where Ax is the sum of the measured intensities of sensors 12902-3 and 12902-4, Bx is the sum of the measured intensities of sensors 12902-1 and 12902-2, Cy is the sum of the measured intensities of sensors 12902-2 and 12902-3, Dy is the sum of the measured intensities of sensors 12902-1 and 12902-4, and α and β are scaling factors.

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[00157] Figure 5D illustrates the distance from center of force 12906 to intensity sensors 12902. In this example, the distances from center of force 12906 to sensors 12902-1 and 12902-4 (e.g., D_S1 and D_S4, respectively) are shorter than the distances from center of force 12906 to sensors 12902-2 and 12902-3 (e.g., D_S2 and D_S3, respectively). In this example, center of force 12906 is closer to sensors 12902-1 and 12902-4 due to the higher intensity measurements of intensity sensors 12902-1 and 12902-4 (e.g., each 9 units of intensity in Figure 5B) in contrast to the intensity measurements of intensity sensors 12902-2 and 12902-3 (e.g., each 7 units of intensity in Figure 5B).

[00158] Figure 5E illustrates determining a location of contacts 12904 relative to center of force 12906. In this example, the distances from center of force 12906 to contacts 12904-1, 12904-2 and 12904-5 (e.g., D_C1, D_C2 and D_C5, respectively) are less than the distances from center of force 12906 to contacts 12904-3 and 12904-4 (e.g., D_C3 and D_C4, respectively).

[00159] Figure 5F illustrates assigning the aggregate intensity (e.g., the sum of the intensity measurements of intensity sensors 12902 in Figure 5B – 32 intensity units) to contacts 12904 based on their distances from the center of force 12906 (e.g., the respective D_C distances in Figure 5E). In this example, each of contacts 12904-1, 12904-2 and 12904-5 are assigned 8 intensity units of the aggregate intensity, and each of contacts 12904-3 and 12904-4 are assigned 4 intensity units of the aggregate intensity. More generally, in some implementations, each contact j is assigned a respective intensity I_j that is portion of the aggregate intensity, A, in accordance with a predefined mathematical function, $I_j = A \cdot (Dj/\sum D_i)$, where D_j is the distance of the respective contact j to the center of force, and $\sum D_i$ is the sum of the distances of all the respective contacts (e.g., i=1 to last) to the center of force.

[00160] Figure 5G illustrates performing an operation based at least in part on the portions of the aggregate intensity assigned to a first contact and a second contact. In this example, each of contacts 12904 move from respective position (a) to respective position (b) (e.g., contact 12904-1 moved from position 12904-1-a to position 12904-1-b) on touch-sensitive surface 451. Figure 5G further illustrates displaying lines 12908 on display 450 in accordance with a change in position of a respective contact 12904, and displaying line thicknesses of lines 12908 on display 450 in accordance with the intensity assigned to the corresponding respective contacts 12904, as described above with reference to Figure 5F. In this example, the respective length of lines 12908 map to the corresponding respective

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change in position of contacts 12904 in Figure 5G (e.g., the length of line 12908-1 maps to the change in position of contact 12904-1 from position 12904-1-a to position 12904-1-b, and the length of line 12908-3 maps to the change in position of contact 12904-3 from position 12904-3-a to position 12904-3-b). Furthermore, in this example, the thicknesses of lines 12908 map to the corresponding respective intensity assigned to contacts 12904, as described above with reference to Figure 5F (e.g., the thickness of line 12908-1 maps to the intensity assigned to contact 12904-1 in Figure 5F, 8 units of intensity, and the thickness of line 12908-3 maps to the intensity assigned to contact 12904-3 in Figure 5F, 4 units of intensity).

[00161] Figure 5H illustrates center of force 12910 at a location closer to contact 12904-1 in comparison to center of force 12906 in Figure 5C (e.g., due to the intensity measurements of intensity sensors 12902 in Figure 5H). In this example, the intensity measurements of intensity sensors 12902-1 and 12902-4 are each 10 units of intensity, and the intensity measurements of intensity sensors 12902-2 and 12902-3 are each 6 units of intensity (e.g., the aggregate intensity is the sum of the intensity measurements of intensity sensors 12902 – 32 units of intensity).

[00162] Figure 5I illustrates center of force 12912 at a location closer to contacts 12904-3 and 12904-4 in comparison to center of force 12906 in Figure 5C (e.g., due to the intensity measurements of intensity sensors 12902 in Figure 5I). In this example, the intensity measurements of intensity sensors 12902-2 and 12902-3 are each 9 units of intensity, and the intensity measurements of intensity sensors 12902-1 and 12902-4 are each 7 units of intensity (e.g., the aggregate intensity is the sum of the intensity measurements of intensity sensors 12902 – 32 units of intensity).

[00163] Figure 5J illustrates contacts 12914 detected on touch-sensitive surface 451 (e.g., contact 12914 are positioned closer to a bottom edge of touch-sensitive surface 451 than contacts 12904 in Figure 5C). Figure 5J further illustrates center of force 12916 at a location relative to contacts 12914 such that the intensities assigned to contacts 12914 in Figure 5J are the same as the intensities assigned to contacts 12904 in Figure 5F.

[00164] Figure 5K illustrates a plurality of contacts 12918 detected on touch-sensitive surface 451. In this example, six contacts are detected on touch-sensitive surface 451 (e.g., contacts 12918 represent a human-user's right hand including a portion of the human-user's palm). Figure 5K further illustrates identifying an incidental contact on touch-sensitive surface 451 (e.g., contact 12918-6 – the portion of the human-user's palm). In this example,

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the intensity measurements of intensity sensors 12902-1 and 12902-4 are each 10 units of intensity, and the intensity measurements of intensity sensors 12902-2 and 12902-3 are each 5 units of intensity (e.g., an aggregate intensity is the sum of the intensity measurements of intensity sensors 12902 – 30 units of intensity).

[00165] Figure 5L illustrates compensating for the presence of a respective incidental contact (e.g., incidental palm contact 12918-6) on touch-sensitive surface 451. In this example, incidental contact 12918-6 is ignored and intensity contributions due to the palm input are, optionally, attributed to the other contacts (e.g., by computing the intensities of the contacts using the total detected intensity without assigning any of the total detected intensity to incidental contact 12918-6). Alternatively, the estimated contribution of incidental contact 12918-6 to the intensity measurements of intensity sensors 12902 is canceled, when determining center of force 12920 based on contact contribution criteria (e.g., a shape, a surface area and/or an intensity of contact 12918-6). For example, in some implements, when a contact fails to satisfy predefined contact contribution criteria, the contact is ignored at least for purposes of determining a center of force, or an estimated intensity contribution of incidental contact 12918-6 (e.g., based on contact size of incidental contact 12918-6 or a predetermined value) is subtracted from the weighted average. Figure 5L further illustrates assigning portions of the aggregate intensity (e.g., a total of 30 units of intensity) to contacts 12918 (e.g., ignoring contact 12918-6). Figure 5L further illustrates contact 12918-6 crossed out due to it being ignored, or due to cancellation of its estimated contribution to the intensity measurements of intensity sensors 12902, in Figure 5K.

[00166] Figures 6A-6C are flow diagrams illustrating a method 13000 of assigning respective portions of an aggregate intensity to a plurality of contacts in accordance with some embodiments. The method 13000 is performed at an electronic device (e.g., device 300, Figure 3, or portable multifunction device 100, Figure 1A) with a display and a touch-sensitive surface. In some embodiments, the display is a touch screen display and the touch-sensitive surface is on the display. In some embodiments, the display is separate from the touch-sensitive surface. Some operations in method 13000 are, optionally, combined and/or the order of some operations is, optionally, be changed.

[00167] As described below, the method 13000 provides an intuitive way to assign respective portions of an aggregate intensity to a plurality of contacts. The method reduces the cognitive burden on a user when assigning respective portions of an aggregate intensity to a plurality of contacts, thereby creating a more efficient human-machine interface. For

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battery-operated electronic devices, enabling a user to assign respective portions of an aggregate intensity to a plurality of contacts faster and more efficiently conserves power and increases the time between battery charges.

[00168] The device detects (13002), on a touch sensitive surface, a plurality of contacts, where a plurality intensity sensors detect intensity of contacts with the touch-sensitive surface. Figure 5B, for example, shows the device detecting a plurality of contacts 12904 (e.g., 5 contacts) on touch-sensitive surface 451 via a plurality of intensity sensors 12902 (e.g., 4 intensity sensors).

[00169] In some embodiments, the plurality of intensity sensors includes (13004) at least four intensity sensors. Figure 5B, for example, shows four intensity sensors 12902. In some embodiments, the number of detected contacts (13006) is greater than the number of intensity sensors (e.g., the device detects five contacts on the touch-sensitive surface and there are four intensity sensors, one on each corner of the touch-sensitive surface). Figure 5B, for example, shows five detected contacts (e.g., contacts 12904) and four intensity sensors 12902 (e.g., a count of the detected contacts 12904 is greater than a count of the intensity sensor units 12902).

[00170] In some embodiments, the touch-sensitive surface has (13008) a plurality of respective corners, and each respective intensity sensor of the plurality of intensity sensors is positioned proximate to a corresponding respective corner. Figure 5B, for example, shows the each intensity sensor of the plurality of intensity sensors 12902 positioned proximate to a corresponding corner of touch-sensitive surface 451.

[00171] In some embodiments, the plurality of intensity sensors define (13010) a perimeter of the device (e.g., a perimeter of the touch-sensitive surface), and the plurality of contacts are detected within the perimeter defined by the plurality of intensity sensors. Figure 5B, for example, shows intensity sensors 12902 defining a perimeter of touch-sensitive surface 451 and the plurality of contacts 12902 detected within the perimeter defined by intensity sensors 12902.

[00172] While detecting (13012) the plurality of contacts, the device receives (13014) a first intensity measurement from a first intensity sensor of the plurality of intensity sensors, and the device also receives (13016) a second intensity measurement from a second intensity sensor of the plurality of intensity sensors, where the first intensity sensor is different second intensity sensor. Figure 5B, for example, shows the device receiving a first intensity

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measurement (e.g., intensity measurement of intensity sensor 12902-1) from a first intensity sensor (e.g., intensity sensor 12902-1) and, also, receiving a second intensity measurement (e.g., intensity measurement of intensity sensor 12902-2) from a second intensity sensor (e.g., intensity sensor 12902-2) while detecting the plurality of contacts 12904 on touch-sensitive surface 451.

[00173] While detecting (13012) the plurality of contacts, the device assigns (13018) a first portion of an aggregate intensity of the contacts to the first contact and assigns a second portion of an aggregate intensity of the contacts to the second contact. Figure 5B, for example, shows an aggregate intensity of the contacts (e.g., the sum of the intensity measurements of intensity sensors 12902 – 32 units of intensity). Figure 5F, for example, shows the device assigning a first portion of the aggregate intensity of the contacts to first contact 12904-1 (e.g., the intensity of contact 12904-1 is 8 units of intensity) while the device detects the plurality of contacts 12904 on touch-sensitive surface 451. Figure 5F, for example, also shows the device assigning a second portion of the aggregate intensity to second contact 12904-2 (e.g., the intensity of contact 12904-2 is 8 units of intensity) while the device detects the plurality of contacts 12904 on touch-sensitive surface 451.

[00174] The device assigns (13018) portions of the aggregate intensity to the plurality of contacts based at least in part on (13020): the first intensity measurement; the second intensity measurement; a location of the first intensity sensor relative to the touch-sensitive surface; and a location of the second intensity sensor relative to the touch-sensitive surface. Figure 5F, for example, shows the device assigning the aggregate intensity (e.g., 32 intensity units) to the plurality of contacts 12904 based at least in part on: the first intensity measurement of intensity sensor 12902-1 in Figure 5B; the second intensity measurement of intensity sensor 12902-2 in Figure 5B; the location of first intensity sensor 12902-1 relative to touch-sensitive surface 451 in Figure 5B; and the location of second intensity sensor 12902-2 relative to touch-sensitive surface 451 in Figure 5B.

[00175] The device also assigns (13018) portions of the aggregate intensity to the plurality of contacts based at least in part on a comparison (13022) between values of a set of one or more properties (e.g., location, distance from center of force, contact size) of the first contact and corresponding values of the set of one or more properties of the second contact. Figure 5F, for example, shows the device assigning the aggregate intensity (e.g., 32 units of intensity) to the plurality of contacts based also at least in part on a comparison between values of a set of one or more properties of first contact 12904-1 (e.g., the distance from

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center of force 12906 to contact 12904-1 in Figure 5E – D_C1) and corresponding values of a set of one or more properties of second contact 12904-2 (e.g., the distance from center of force 12906 to contact 12904-2 in Figure 5E – D_C2).

[00176] In some embodiments, the set of one or more properties for a respective contact includes (13024) a location of the respective contact on the touch-sensitive surface. The location of the contact on the touch-sensitive surface is, optionally, relative to one or more other detected contacts, relative to a center of force (e.g., the corresponding D_C distances of respective contacts 12904 in Figure 5E), or relative to one or more intensity sensors. In some embodiments, the set of one or more properties of a respective contact includes (13026) a contact size of the respective contact on the touch-sensitive surface. In some embodiments, relative intensity of contacts can be determined based in part on an absolute contact size or a change in contact size, because as a finger is pressed onto the touch-sensitive surface, more of the finger comes into contact with the touch-sensitive surface. Thus, as a user presses a finger down harder onto the touch-sensitive surface, the size of a contact corresponding to the finger increases.

[00177] In some embodiments, the device includes (13028) a number of intensity sensors, the aggregate intensity is divided between a number of detected contacts, and the number of detected contacts is greater than the number of intensity sensors. In some implementations, the number of intensity sensors is four or more. Figure 5F, for example, shows the aggregate intensity (e.g., the sum of the intensity measurements of intensity sensors 12902 in Figure 5B – 32 units of intensity) divided between the number of detected contacts 12904 on touch-sensitive surface 451 (e.g., the sum of the intensities of contacts 12904 in Figure 5F equals the aggregate intensity – 32 units of intensity). Also, in Figure 5F, for example, the number of detected contacts 12904 (e.g., five) is greater than the number of intensity sensors 12902 (e.g., four).

[00178] In response to detecting the plurality of contacts, the device performs (13030) an operation based at least in part on the portion of the aggregate intensity assigned to the first contact. In some embodiments, means for performing an operation are enabled while means for detecting the plurality of contacts are detecting the plurality of contacts. In some embodiments, the operation is based (13032) at least in part on the portion of the aggregate intensity assigned to the second contact. Figure 5G, for example, shows the device performing an operation (e.g., displaying lines 12908 on display 450) based at least in part on the portions of the aggregate intensity assigned to the first contact and the second contact

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(e.g., the thickness of lines 12908-1 and 12908-2 correspond to the intensity assigned to corresponding contacts 12904-1 and 12904-2, respectively, in Figure 5F).

[00179] In some embodiments, the device determines (13034) a center of force on the touch-sensitive surface based at least in part on: the location of the first intensity sensor relative to the touch-sensitive surface; the location of the second intensity sensor relative to the touch-sensitive surface; the first intensity measurement of the first intensity sensor; and the second intensity measurement of the second intensity sensor. In some embodiments, the center of force is a weighted average of the locations of intensity sensors 12902 (e.g., the corresponding D_S distances from respective intensity sensors 12902 to center of force 12906), where the intensity contributions of each of intensity sensors 12902 are weighted in accordance with the respective intensity measurement that corresponds to the respective intensity sensor. Figure 5C, for example, shows center of force 12906 determined based at least in part on: the location of the first intensity sensor 12902-1 relative to touch-sensitive surface 451; the location of the second intensity sensor 12902-2 relative to touch-sensitive surface 451; the first intensity measurement of first intensity sensor 12902-1 in Figure 5B; and the second intensity measurement of second intensity sensor 12902-2 in Figure 5B. In some embodiments, the center of force on the touch-sensitive surface is determined prior to, or as part of, assigning portions of the intensity of contacts on the touch-sensitive surface (as described in greater detail above with reference to operation 13018).

[00180] In some embodiments, determining the center of force includes (13036): identifying one or more incidental contacts on the touch-sensitive surface (e.g., a palm contact or accidental finger contact); and compensating for the presence of a respective incidental contact on the touch-sensitive surface (e.g., ignoring the incidental contact, or cancelling an estimated contribution of the incidental contact to the aggregate intensity). Figure 5L, for example, shows identifying an incidental contact (e.g., contacts 12918-6) on touch-sensitive surface 451 and compensating for the presence of contact 12918-6 on touch-sensitive surface 451 (e.g., by cancelling the estimated contribution of incidental contact 12918-6 to the intensity measurements of intensity sensors 12902 in Figure 5K) when determining center of force 13020.

[00181] In some embodiments, the device determines (13038) a location of the first contact relative to the center of force, determines a location of the second contact relative to the center of force, assigns the first portion of the aggregate intensity to the first contact based on the location of the first contact relative to the center of force, and assigns the second

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portion of the aggregate intensity to the second contact based on the location of the second contact relative to the center of force. In some embodiments, the aggregate intensity is divided between the detected contacts, including the first contact and the second contact, based on a comparison between the location of the first contact relative to the center of force and the location of the second contact relative to the center of force, so that more intensity is assigned to the contact that is closer to the center of force (e.g., the aggregate intensity is assigned to contacts based on the assumption that the intensity contribution of a respective contact is proportional to the distance of the contact to the center of force). In some implementations, the center of force is determined using the predefined mathematical function described above with reference to Figure 5C. Furthermore, in some implementations, the portion of the aggregate intensity assigned to respective detected contacts is determined using the predefined mathematical function described above with reference to Figure 5F. In some embodiments, locations of the contacts are determined prior to, or as part of, assigning portions of the intensity of contacts on the touch-sensitive surface (as described in greater detail above with reference to operation 13018).

[00182] For example, the intensity contributions of the plurality of contacts are determined so that the center of force is located on the touch-sensitive surface in accordance with a weighted average of the locations of the plurality of contacts, where the locations of each of the respective contacts is weighted in accordance with a respective portion of the aggregate intensity that is assigned to the respective contact (e.g., the portions of the aggregate intensity that are assigned to particular contacts are determined by reversing the computation of a weighted average, starting with the total intensity, the location of the weighted average and the locations of the contacts and working backwards to determine the weights for the different contacts). For example, if four intensity sensors identify an aggregate intensity of 4 units of intensity at a respective point (e.g., the center of force) on the touch-sensitive surface, and the device detects two contacts on the touch-sensitive surface, a first contact 1 centimeter from the respective point, a second contact 3 centimeters from the respective point and directly across from the first contact, the device would assign 75% of the intensity (e.g., 3 units of intensity) to the first contact and 25% of the intensity (e.g., 1 unit of intensity) to the second contact.

[00183] Figure 5E, for example, shows the device determining a location of first contact 12904-1 relative to center of force 12906 (e.g., distance D_C1) and a location of second contact 12904-2 relative to center of force 12906 (e.g., distance D_C2). Figure 5F, for example,

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further shows the device assigning the first portion of the aggregate intensity (e.g., the sum of the intensity measurements of intensity sensors 12902 in Figure 5B) to first contact 12904-1 (e.g., intensity of contact 12904-1 – 8 units of intensity) based on the location of first contact 12904-1 relative to center of force 12906 (e.g., distance D_C1) and the second portion of the aggregate intensity (e.g., the sum of the intensity measurements of intensity sensors 12902 in Figure 5B) to second contact 12904-2 (e.g., intensity of contact 12904-2 – 8 units of intensity) based on the location of second contact 12904-2 relative to center of force 12906 (e.g., distance D_C2).It should be understood that the particular order in which the operations in Figures 6A-6C have been described is merely exemplary and is not intended to indicate that the described order is the only order in which the operations could be performed. One of ordinary skill in the art would recognize various ways to reorder the operations described herein. Additionally, it should be noted that details of other processes described herein with respect to other methods described herein (e.g., those listed in paragraph [0045]) are also applicable in an analogous manner to method 13000 described above with respect to Figures 6A-6C. For example, the contacts described above with reference to method 13000 optionally have one or more of the characteristics of the contacts described herein with reference to other methods described herein (e.g., those listed in paragraph [0045]). For brevity, these details are not repeated here.

[00184] In accordance with some embodiments, Figure 7 shows a functional block diagram of an electronic device 13100 configured in accordance with the principles of the various described embodiments. The functional blocks of the device are, optionally, implemented by hardware, software, or a combination of hardware and software to carry out the principles of the various described embodiments. It is understood by persons of skill in the art that the functional blocks described in Figure 7 are, optionally, combined or separated into sub-blocks to implement the principles of the various described embodiments. Therefore, the description herein optionally supports any possible combination or separation or further definition of the functional blocks described herein.

[00185] As shown in Figure 7, an electronic device 13100 includes: a display unit 13102 configured to display information; a touch-sensitive surface unit 13104 configured to receive contacts; a plurality of intensity sensor units 13106 to detect intensity of contacts with the touch-sensitive surface 13104; and a processing unit 13108 coupled to the display unit 13102, the touch-sensitive surface unit 13104 and the plurality of intensity sensor units 13106. In some embodiments, the processing unit 13108 includes a detecting unit 13110, a

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receiving unit 13112, an assigning unit 13114, a performing unit 13116, a determining unit 13118, an identifying unit 13120, and a compensating unit 13122.

[00186] The processing unit 13108 is configured to detect (e.g., with the detecting unit 13110), on the touch-sensitive surface unit 13104, a plurality of contacts. While detecting the plurality of contacts, the processing unit 13108 is further configured to: receive (e.g., with the receiving unit 13112) a first intensity measurement from a first intensity sensor unit 13106-1 of the plurality of intensity sensors unit 13106; receive (e.g., with the receiving unit 13112) a second intensity measurement from a second intensity sensor unit 13106-2 of the plurality of intensity sensor units 13106, wherein the first intensity sensor unit 13106-1 is different from the second intensity sensor unit 13106-2; and assign (e.g., with the assigning unit 13114) a first portion of an aggregate intensity of the contacts to the first contact and assign (e.g., with the assigning unit 13114) a second portion of the aggregate intensity to the second contact. The processing unit 13108 is configured to assign (e.g., with the assigning unit 13114) the aggregate intensity based at least in part on: the first intensity measurement; the second intensity measurement; a location of the first intensity sensor unit 13106-1 relative to the touch-sensitive surface unit 13104; a location of the second intensity sensor unit 13106-2 relative to the touch-sensitive surface unit 13104; and a comparison between values of a set of one or more properties of the first contact and corresponding values of the set of one or more properties of the second contact. In response to detecting the plurality of contacts, the processing unit 13108 is further configured to perform (e.g., with the performing unit 13116) an operation based at least in part on the portion of the aggregate intensity assigned to the first contact.

[00187] In some embodiments, the operation is based at least in part on the portion of the aggregate intensity assigned to the second contact.

[00188] In some embodiments, the number of detected contacts is greater than the number of intensity sensor units 13106.

[00189] In some embodiments, the device includes a number of intensity sensor units 13106, the aggregate intensity is divided between a number of detected contacts, and the number of detected contacts is greater than the number of intensity sensor units 13106.

[00190] In some embodiments, the plurality of intensity sensor units 13106 define a perimeter on the device, and the plurality of contacts are detected within the perimeter defined by the plurality of intensity sensor units 13106.

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[00191] In some embodiments, the plurality of intensity sensor units 13106 includes at least four intensity sensor units.

[00192] In some embodiments, the touch-sensitive surface unit 13104 has a plurality of respective corners, and each respective intensity sensor unit of the plurality of intensity sensor units 13106 is positioned proximate to a corresponding respective corner.

[00193] In some embodiments, the set of one or more properties for a respective contact includes a location of the respective contact on the touch-sensitive surface unit 13104.

[00194] In some embodiments, the set of one or more properties of a respective contact include a contact size of the respective contact on the touch-sensitive surface unit 13104.

[00195] In some embodiments, the processing unit 13108 is further configured to determine (e.g., with the determining unit 13118) a center of force on the touch-sensitive surface unit 13104 based at least in part on: the location of the first intensity sensor unit 13106-1 relative to the touch-sensitive surface unit 13104; the location of the second intensity sensor unit 13106-2 relative to the touch-sensitive surface unit 13104; the first intensity measurement of the first intensity sensor unit 13106-1; and the second intensity measurement of the second intensity sensor unit 13106-2.

[00196] In some embodiments, determining (e.g., with the determining unit 13118) the center of force includes: identifying (e.g., with the identifying unit 13120) one or more incidental contacts on the touch-sensitive surface unit 13104; and compensating (e.g., with the compensating unit 13122) for the presence of a respective incidental contact on the touch-sensitive surface unit 13104.

[00197] In some embodiments, the processing unit 13108 is configured to: determine (e.g., with the determining unit 13118) a location of the first contact relative to the center of force; determine (e.g., with the determining unit 13118) a location of the second contact relative to the center of force; assign (e.g., with the assigning unit 13114) the first portion of the aggregate intensity to the first contact based on the location of the first contact relative to the center of force; and assign (e.g., with the assigning unit 13114) the second portion of the aggregate intensity to the second contact based on the location of the second contact relative to the center of force.

[00198] The operations in the information processing methods described above are, optionally, implemented by running one or more functional modules in information

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processing apparatus such as general purpose processors (e.g., as described above with respect to Figures 1A and 3) or application specific chips.

[00199] The operations described above with reference to Figures 6A-6C are, optionally, implemented by components depicted in Figures 1A-1B or Figure 7. For example, detecting operation 13002, receiving operations 13014-13016, assigning operation 13018, and determining operation 13034 are, optionally, implemented by event sorter 170, event recognizer 180, and event handler 190. Event monitor 171 in event sorter 170 detects a contact on touch-sensitive display 112, and event dispatcher module 174 delivers the event information to application 136-1. A respective event recognizer 180 of application 136-1 compares the event information to respective event definitions 186, and determines whether a first contact at a first location on the touch-sensitive surface corresponds to a predefined event or sub-event, such as selection of an object on a user interface. When a respective predefined event or sub-event is detected, event recognizer 180 activates an event handler 190 associated with the detection of the event or sub-event. Event handler 190 optionally utilizes or calls data updater 176 or object updater 177 to update the application internal state 192. In some embodiments, event handler 190 accesses a respective GUI updater 178 to update what is displayed by the application. Similarly, it would be clear to a person having ordinary skill in the art how other processes can be implemented based on the components depicted in Figures 1A-1B.

Transitioning between Touch Input to Display Output Relationships

[00200] Many electronic devices have graphical user interfaces that include various user interface objects that are controlled in accordance with input-output relationships between inputs and corresponding outputs. In some situations there is a constant input-output relationship between inputs and corresponding outputs. However, a constant input-output relationship can be distracting an inefficient for a user when there is a particular range of outputs that the user is likely to want to achieve. However, a variable input-output relationship can also be confusing and disconcerting to a user if the user notices discontinuities in the input-output relationship. The embodiments described below improve on these methods by providing an efficient and intuitive way of transitioning between touch input to display output relationships when interacting with user interface objects. In particular, in accordance with some embodiments described below, some user interface objects have two or more touch input to display output relationships that govern how those

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objects are displayed in response to user inputs, especially touch inputs. For example, in some circumstances, opening a file folder involves an animation progression with multiple stages or options depending on the properties of the user input. .

[00201] Figures 8A-8V illustrate exemplary user interfaces for transitioning between touch input to display output relationships using inputs on a touch-sensitive surface in accordance with some embodiments. The user interfaces in these figures are used to illustrate the processes described below, including the processes described below with reference to Figures 9A-9C. Figures 8B-8I and 8N-8T include intensity diagrams that show the current intensity of the contact on the touch-sensitive surface relative to a plurality of intensity thresholds including a respective threshold (e.g., "IT_D"). In some embodiments, operations similar to those described below with reference to IT_D are performed with reference to a different intensity threshold (e.g., "IT_L").

[00202] Figures 8A illustrates an example user interface 13204, including files icon 13205, displayed on display 450 of a device (e.g., device 300) and responsive to inputs (e.g., a finger contact) on touch-sensitive surface 451. Figure 8A further illustrates intensity sensors 13208 to detect the intensity of contacts on touch-sensitive surface 451. Figure 8A also shows contact 13202 and intensity of contact 13202 as well as additional intensity range 13210 corresponding to the relative location of contact 13202 on touch-sensitive surface 451 and intensity sensors 13208. In accordance with some embodiments, Figure 8A also illustrates a displayed representation of a focus selector (e.g., cursor 13206) corresponding to input 13202 detected on touch-sensitive surface 451.

[00203] In some embodiments, the device is an electronic device with a separate display (e.g., display 450) and a separate touch-sensitive surface (e.g., touch-sensitive surface 451). In some embodiments, the device is portable multifunction device 100, the display is touch-sensitive display system 112, and the touch-sensitive surface includes contact intensity sensor(s) 165 on the display (Figure 1A). For convenience of explanation, the embodiments described with reference to Figures 8A-8K and 9A-9C will be discussed with reference to display 450 and a separate touch-sensitive surface 451, however analogous operations are, optionally, performed on a device with a touch-sensitive display system 112 in response to detecting the contacts described in Figures 8A-8K on the touch-sensitive display system 112 while displaying the user interfaces shown in Figures 8A-8K on the touch-sensitive display system 112; in such embodiments, the focus selector is, optionally: a respective contact, a representative point corresponding to a contact (e.g., a centroid of a respective contact or a

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point associated with a respective contact), or a centroid of two or more contacts detected on the touch-sensitive display system 112, in place of cursor 13206. Likewise, for embodiments discussed with reference with a touch-sensitive display system 112 (e.g., as shown in Figures 8M-8V), analogous operations are, optionally, performed on a device with display 450 and a separate touch-sensitive surface 451 in response to detecting the contacts described in Figures 8M-8V on the touch-sensitive surface 451 while displaying the user interfaces shown in Figures 8M-8V on the display 450. In embodiments where a display 450 and touch-sensitive surface 451 replace touch screen 112, the focus selector is, optionally: a cursor, a magnifying glass, or a spotlight, in place of a respective contact (e.g., contact 13228 in Figures 8M-8V), a representative point corresponding to a contact, or a centroid of two or more contacts detected on the touch-sensitive display system 112.

[00204] In some embodiments, cursor 13206 is a displayed representation of the focus selector with a position on display 450 that is determined in accordance with contacts received by touch-sensitive surface 451. In other implementations the focus selector has a different displayed representation (e.g., a magnifying glass). Alternatively, in some implementations a representation of the focus selector is not displayed. For example, in implementations using a touch-sensitive display system, the position of the focus selector corresponds to the location on the display of a contact or gesture. Further, the focus selector is herein defined to be "over" a user interface object when the position of the focus selector corresponds to the location on the display of the user interface object.

[00205] Figures 8B-8K illustrate an example of adjusting the progress of an animation in accordance with intensity of a contact. Figures 8B-8E illustrate an animation displaying the files associated with files icon 13205 progressing in accordance with a first touch input to display output relationship as intensity of contact 13202 increases from just above IT_L to just below IT_D. Figure 8F illustrates a transition point in the animation progress as intensity of contact 13202 reaches IT_D. Figures 8G-8I illustrate the animation progressing in accordance with a second touch input to display output relationship as intensity of contact 13202 increases beyond IT_D. Figures 8J-8K illustrate lift-off of contact 13202 and an animation that returns (e.g., bounces back) the graphical representation of files associated with file icon 13205 to the state shown in Figure 8F.

[00206] Figure 8L illustrates an example of adjusting an output in response to change in input (e.g., change in intensity of a finger contact). Figure 8L shows first touch input to display output response 13216 (e.g., a linear response) corresponding to first range of

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intensity values 13212 between IT_L and IT_D. Figure 8L also shows touch input to display output response transition point 13217 corresponding to intensity IT_D and a smooth transition to second touch input to display output response 13218 (e.g., a cubic spline response) corresponding to second range of intensity values 13214 between IT_D and IT_{MAX}. Figure 8L further shows the output approaching max output 13220 as the input approaches IT_{MAX}.

[00207] Figure 8M illustrates an example user interface 13226, including menu bar 13227, displayed on touch-sensitive display 13222, which is responsive to inputs (e.g., a finger contact). Figure 8M further illustrates intensity sensors 13232 to detect the intensity of contacts on touch-sensitive display 13222.

[00208] Figures 8N-8V illustrate another example of adjusting the progress of an animation in accordance with intensity of a contact. Figures 8N-8O show contact 13228 detected over the "Tools" option on menu bar 13227 and intensity of contact 13228 as well as additional intensity range 13230 corresponding to the relative location of contact 13228 on touch-sensitive display 13222 and intensity sensors 13232. Figures 8N-8O further show graph 13236 displaying output response (e.g., animation progress) in accordance with change in intensity of contact 13228. In Figures 8N-8O, the animation of "Tools" sub-menu 13240 progresses as intensity of contact 13228 increases from just above IT_0 (in Figure 8N) to just below IT_L (in Figure 8O) in accordance with a first touch input to display output response. Figure 8P shows intensity of contact 13228 reaching IT_L and animation progress reaching touch input to display output transition point 13238. Figure 8P also shows the entirety of "Tools" sub-menu 13240. Figures 8Q-8T illustrate the animation of "Tools" sub-menu 13240 progressing as intensity of contact 13228 increases above IT_L in accordance with a second touch input to display output response. Figures 8U-8V illustrate lift-off of contact 13228 and an animation that returns (e.g., bounces back) the graphical representation of "Tools" sub-menu 13240 to the state shown in Figure 8P.

[00209] Figures 9A-9C are flow diagrams illustrating method 13300 of transitioning between input-output relationships (e.g., touch input to display output relationships) in accordance with some embodiments. Method 13300 is performed at an electronic device (e.g., device 300, Figure 3, or portable multifunction device 100, Figure 1A) with a display and a touch-sensitive surface. In some embodiments, the display is a touch screen display and the touch-sensitive surface is on the display. In some embodiments, the display is separate from the touch-sensitive surface. Some operations in method 13300 are, optionally, combined and/or the order of some operations is, optionally, changed.

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[00210] As described below, method 13300 provides an intuitive way to transition between input-output relationships. The method reduces the cognitive burden on a user when navigating user interface hierarchies, thereby creating a more efficient human-machine interface. For battery-operated electronic devices, enabling a user to transition between touch input to display output relationships faster and more efficiently conserves power and increases the time between battery charges.

[00211] In some embodiments, the device displays (13301) a user interface that includes a plurality of user interface objects, where the plurality of user interface objects respond to press inputs having intensity above corresponding activation intensity thresholds (e.g., activation intensity thresholds that correspond to respective ones of the user interface objects) and a respective activation intensity threshold for two or more of the user interface objects is the same as a transitional intensity value. For example, one or more buttons, links, menus, or other selectable user interface elements are selected by the device in response to detecting a contact with intensity above a transitional intensity value while a corresponding focus selector is over the user interface element. In these embodiments, for example, in Figure 8N one or more of the menu options in menu bar 13227 have the same IT_L and input-output transition point 13238 as the "Tools" option.

[00212] The device detects (13302) a contact (e.g., a finger contact) on the touch-sensitive surface. For example, in Figure 8A the device detects contact 13202 on touch-sensitive surface 451.

[00213] The device determines (13304) a location of the contact on the touch-sensitive surface (e.g., a current (x,y) position of a representative point in the contact, such as the centroid of the contact). For example, the device in Figure 8A determines the position of contact 13202 on touch-sensitive surface 451.

[00214] The device determines (13306) an intensity of the contact on the touch-sensitive surface. In some embodiments, determining the intensity of the contact on the touch-sensitive surface includes generating a plurality of measurements of the intensity of the contact over time so as to detect changes in the intensity of the contact over time. For example, the device in Figure 8A determines intensity of contact 13202 on touch-sensitive surface 451.

[00215] The device displays (13308) a response in accordance with the detected contact (e.g., displaying a response in accordance with an intensity of the contact and/or a

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change in intensity of the contact), the response being based at least in part on an input-output mapping of intensity to response at the location of the contact on the touch-sensitive surface. For example, in Figures 8B-8K the device displays an animation progression in accordance with intensity of contact 13202.

[00216] The input-output mapping includes (13310), for a respective location on the touch-sensitive surface: a first input-output relationship between intensity and response over a first range of intensity values, a second input-output relationship between intensity and response over a second range of intensity values, the second range of intensity values being different from the first range of intensity values, and a transitional intensity value where the first range of intensity values meets or overlaps the second range of intensity values, where, at the transitional intensity value: the first input-output relationship has a first rate of change of response with change in intensity, the second input-output relationship has a second rate of change of response with change in intensity, and the first rate of change is substantially the same as the second rate of change. In some embodiments, the first rate of change is substantially the same as the second rate of change when the first rate of change is within a margin of 10% or 20% of the second rate of change. In some embodiments, the first rate of change is the same as the second rate of change. For example, in Figures 8N-8T the device displays an animation progressing in accordance with intensity of contact 13228. In this example, Figures 8N-8O illustrate the animation progressing in accordance with a first input-output relationship as intensity of contact 13228 increases from slightly above IT_0 to slightly below IT_L, Figure 8P illustrates a smooth transition in the animation at transitional intensity value IT_L, and Figures 8Q-8T illustrate the animation progressing in accordance with a second input-output relationship as intensity of contact 13228 increases above IT_L.

[00217] In some embodiments, the second input-output relationship and the first input-output relationship have (13312) a same output at the transitional intensity value (e.g., there is a continuous transition between the first input-output relationship and the second input-output relationship). For example, Figures 8O-8Q illustrate a continuous transition in animation progression at input-output transition point 13238 corresponding to transitional intensity value IT_L.

[00218] In some embodiments, the first input-output relationship is (13314) linear. For example, in Figure 8L first input-output response 13216, corresponding to first range of intensity values 13212, is linear.

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[00219] In some embodiments, the second input-output relationship is (13316) non-linear (e.g., the second input-output relationship is a cubic spline curve). For example, in Figure 8L second input-output response 13218, corresponding to second range of intensity values 13214, is non-linear.

[00220] In some embodiments, the second input-output relationship asymptotically approaches (13318) a maximum output as intensity of the contact increases above the transition intensity value. For example, an animation has a maximum extent and the maximum extent of the animation is approached asymptotically as the intensity of the contact increases toward a respective maximum intensity at the location of the contact on the touch-sensitive surface. In Figures 8Q-8T, for example, the animation asymptotically approaches maximum extent 13240 as intensity of contact 13228 increases toward the respective maximum intensity corresponding to the location of contact 13228 on touch-sensitive display 13222.

[00221] In some embodiments, a first property of the device (e.g., a dynamic range of the device for detecting intensity of a contact on the touch-sensitive surface) varies (13320) at different locations on the touch-sensitive surface. In some implementations, the first input-output relationship is the same at a first location and a second location on the touch-sensitive surface and the second input-output relationship is different at the first location than at the second location on the touch-sensitive surface. For example, the second input-output relationship is selected or defined by the device in response to current conditions of the device, so as to provide a smooth transition from the fixed first input-output relationship to the dynamic second input-output relationship while also taking into account limitations on detecting intensity at the location of the contact, such as the dynamic range of intensity detection at the location of the contact. In these embodiments, for example, the first input-output relationship in Figures 8N-8P is the same for different locations of contact 13228 on touch-sensitive display 13222 and the second input-output relationship in Figures 8Q-8T is different for different locations of contact 13228 on touch-sensitive display 13222.

[00222] In some embodiments, the response includes (13322) changing a current value of a property from a first value to a second value in a predefined range of values. For example, changing the files animation progress from a first value in Figure 8B to a second value in Figure 8C.

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[00223] In some embodiments, the response includes (13324) adjusting one or more of: volume, brightness, user interface object spacing, user interface object size, user interface object opacity, content scrubbing, and animation progress. For example, successive adjustments to a files animation progress is illustrated in Figures 8B-8K.

[00224] It should be understood that the particular order in which the operations in Figures 9A-9C have been described is merely exemplary and is not intended to indicate that the described order is the only order in which the operations could be performed. One of ordinary skill in the art would recognize various ways to reorder the operations described herein. Additionally, it should be noted that details of other processes described herein with respect to other methods described herein (e.g., those listed in paragraph [0045]) are also applicable in an analogous manner to method 13300 described above with respect to Figures 9A-9C. For example, the contacts, contact locations, contact intensities, user interfaces, input-output mappings, input-output relationships, and responses described above with reference to method 13300 optionally have one or more of the characteristics of the contacts, contact locations, contact intensities, user interfaces, input-output mappings, input-output relationships, and responses described herein with reference to other methods described herein (e.g., those listed in paragraph [0045]). For brevity, these details are not repeated here.

[00225] In accordance with some embodiments, Figure 10 shows a functional block diagram of an electronic device 13400 configured in accordance with the principles of the various described embodiments. The functional blocks of the device are, optionally, implemented by hardware, software, or a combination of hardware and software to carry out the principles of the various described embodiments. It is understood by persons of skill in the art that the functional blocks described in Figure 10 are, optionally, combined or separated into sub-blocks to implement the principles of the various described embodiments. Therefore, the description herein optionally supports any possible combination or separation or further definition of the functional blocks described herein. As shown in Figure 10, electronic device 13400 includes display unit 13402 configured to display a response in accordance with a detected contact, touch-sensitive surface unit 13404 configured to receive user contacts, one or more sensor units 13405 configured to detect intensity of contacts with the touch-sensitive surface unit, and processing unit 13406 coupled to display unit 13402, touch-sensitive surface unit 13404, and sensor units 13405. In some embodiments, processing unit 13406 includes detecting unit 13408, determining unit 13410, and display enabling unit 13412.

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[00226] Processing unit 13406 is configured to detect (e.g., with detecting unit 13408) a contact on the touch-sensitive surface unit, determine (e.g., with determining unit 13410) a location of the contact on the touch-sensitive surface unit, determine (e.g., with determining unit 13410) an intensity of the contact on the touch-sensitive surface unit, and enable display of (e.g., with display enabling unit 13412) a response in accordance with the detected contact, the response being based at least in part on an input-output mapping of intensity to response at the location of the contact on the touch-sensitive surface unit. The input-output mapping includes, for a respective location on the touch-sensitive surface unit, a first input-output relationship between intensity and response over a first range of intensity values, a second input-output relationship between intensity and response over a second range of intensity values, the second range of intensity values being different from the first range of intensity values, and a transitional intensity value where the first range of intensity values meets or overlaps the second range of intensity values. At the transitional intensity value, the first input-output relationship has a first rate of change of response with change in intensity, the second input-output relationship has a second rate of change of response with change in intensity, and the first rate of change is substantially the same as the second rate of change.

[00227] In some embodiments, the second input-output relationship and the first input-output relationship have a same output at the transitional intensity value.

[00228] In some embodiments, the first input-output relationship is linear.

[00229] In some embodiments, the second input-output relationship is non-linear.

[00230] In some embodiments, the second input-output relationship asymptotically approaches a maximum output as intensity of the contact increases above the transition intensity value.

[00231] In some embodiments, processing unit 13406 is further configured to enable display of (e.g., with display enabling unit 13412) a user interface that includes a plurality of user interface objects, where the plurality of user interface objects respond to press inputs having an intensity above corresponding activation intensity thresholds, and a respective activation intensity threshold for two or more of the user interface objects is the same as the transitional intensity value.

[00232] In some embodiments, a first property of the device varies at different locations on touch-sensitive surface unit 13404, the first input-output relationship is the same at a first location and a second location on touch-sensitive surface unit 13404, and the second

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input-output relationship is different at the first location than at the second location on touch-sensitive surface unit 13404.

[00233] In some embodiments, the response includes changing a current value of a property from a first value to a second value in a predefined range of values.

[00234] In some embodiments, the response includes adjusting one or more of: volume, brightness, user interface object spacing, user interface object size, user interface object opacity, content scrubbing, and animation progress.

[00235] The operations in the information processing methods described above are, optionally implemented by running one or more functional modules in information processing apparatus such as general purpose processors (e.g., as described above with respect to Figures 1A and 3) or application specific chips. The operations described above with reference to Figures 9A-9C is optionally implemented by components depicted in Figures 1A-1B or Figure 10. For example, detection operation 13302, determining operations 13304 and 13306, and displaying operation 13308 are, optionally, implemented by event sorter 170, event recognizer 180, and event handler 190. Event monitor 171 in event sorter 170 detects a contact on touch-sensitive display 112, and event dispatcher module 174 delivers the event information to application 136-1. A respective event recognizer 180 of application 136-1 compares the event information to respective event definitions 186, and determines whether a first contact at a first location on the touch-sensitive surface corresponds to a predefined event or sub-event, such as selection of an object on a user interface. When a respective predefined event or sub-event is detected, event recognizer 180 activates an event handler 190 associated with the detection of the event or sub-event. Event handler 190 optionally utilizes or calls data updater 176 or object updater 177 to update the application internal state 192. In some embodiments, event handler 190 accesses a respective GUI updater 178 to update what is displayed by the application. Similarly, it would be clear to a person having ordinary skill in the art how other processes can be implemented based on the components depicted in Figures 1A-1B.

Adjusting Outputs with Changes in Contact Intensity and Varying Dynamic Range of Intensity Detection

[00236] Many electronic devices have touch-sensitive surfaces. The touch-sensitive surfaces optionally utilizes multiple intensity sensors and have a maximum intensity detection threshold that varies with location on the touch-sensitive surface. This variation in

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maximum intensity detection threshold can be addressed by using a uniform maximum intensity detection threshold for the whole touch-sensitive surface that is a lowest common denominator maximum intensity detection threshold. However, this approach keeps the device from being used to its full potential and thus provides a less efficient and effective user interface. The embodiments described below improve on these methods by dynamically adjusting input-output relationships to take advantage of maximum intensity detection thresholds that are higher than the maximum intensity thresholds on the least sensitive portions of the touch-sensitive surface. For example, in some circumstances, a touch-sensitive surface with multiple intensity sensors has, at a first location, a maximum intensity corresponding to 500g of force, and, at a second location, a maximum intensity corresponding to 2000g of force. In this example, it is desirable to utilize the additional intensity range at the second location. The embodiments described below provide an efficient and intuitive way of adjusting outputs with changes in contact intensity and varying dynamic range of intensity detection, thereby enabling the device to control convenient and efficient user interfaces.

[00237] Figures 11B-11U illustrate exemplary user interfaces for adjusting outputs with changes in contact intensity and varying dynamic range of intensity detection in accordance with some embodiments. The user interfaces in these figures are used to illustrate the processes described below, including the processes described below with reference to Figures 12A-12D. Figures 11B-11J and 11M-11U include intensity diagrams that show the current intensity of the contact on the touch-sensitive surface relative to a plurality of intensity thresholds including a respective threshold (e.g., "IT_D"). In some embodiments, operations similar to those described below with reference to IT_D are performed with reference to a different intensity threshold (e.g., "IT_L").

[00238] Figure 11A illustrates an example of adjusting outputs in response to change in inputs (e.g., change in intensity of a finger contact). Figure 11A shows first input-output mapping 13501 including: first input-output response 13502 (e.g., a linear response) corresponding to a range of intensity values between IT_L and IT_D, input-output response transition point 13504 corresponding to intensity IT_D, a smooth transition to second input-output response 13506 (e.g., a cubic spline response) corresponding to a range of intensity values between IT_D and IT_{MAX1}, and the output approaching max output 13508 as the input approaches IT_{MAX1}. Figure 11A further shows second input-output mapping 13509 including: first input-output response 13510 corresponding to a range of intensity values between IT_L

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and IT_D, input-output response transition point 13512 corresponding to intensity IT_D, a smooth transition to second input-output response 13514 corresponding to a range of intensity values between IT_D and IT_{MAX2}, and the output approaching max output 13516 as the input approaches IT_{MAX2}.

[00239] Figures 11B illustrates an example user interface 13520, including menu bar 13521 and Tools submenu 13523, displayed on touch-sensitive display 13518. Figure 11B further illustrates intensity sensors 13522 to detect the intensity of contacts on touch-sensitive display 13518. Figure 11B also shows contact 13524 and intensity of contact 13524 as well as additional dynamic range 13526 corresponding to the relative location of contact 13524 on touch-sensitive display 13518 and intensity sensors 13522. Figure 11B further shows contact 13528 and intensity of contact 13528 as well as additional dynamic range 13530 corresponding to the relative location of contact 13528 on touch-sensitive display 13518 and intensity sensors 13522.

[00240] Figures 11C-11L illustrate an example of adjusting the progress of an animation in accordance with intensity of a contact. Figure 11C illustrates user interface 13532, including files icon 13534, displayed on display 450 of a device (e.g., device 300). Figure 11C further illustrates contact 13540 detected on touch-sensitive surface 451, intensity of contact 13540 below IT_L, intensity sensors 13538, and additional dynamic range 13542 corresponding to the relative location of contact 13540 on touch-sensitive surface 451 and intensity sensors 13538. In accordance with some embodiments, Figures 11C-11L illustrate a displayed representation of focus selector (e.g., cursor 13536) corresponding to input 13540 detected on touch-sensitive surface 451. Figures 11D-11G illustrate an animation displaying the files associated with files icon 13505 progressing in accordance with a first input-output relationship as intensity of contact 13540 increases from IT_L to just below IT_D. Figure 11H illustrates a transition point in the animation progress as intensity of contact 13540 reaches IT_D. Figures 11I-11J illustrate the animation progressing in accordance with a second input-output relationship as intensity of contact 13540 increases beyond IT_D. Figures 11K-11L illustrate lift-off of contact 13540 and an animation that returns (e.g., bounces back) the graphical representation of files associated with file icon 13534 to the state shown in Figure 11H.

[00241] In some embodiments, the device is an electronic device with a separate display (e.g., display 450) and a separate touch-sensitive surface (e.g., touch-sensitive surface 451). In some embodiments, the device is portable multifunction device 100, the display is

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touch-sensitive display system 112, and the touch-sensitive surface includes contact intensity sensor(s) 165 on the display (Figure 1A).

[00242] In some embodiments, the device is an electronic device with a separate display (e.g., display 450) and a separate touch-sensitive surface (e.g., touch-sensitive surface 451). In some embodiments, the device is portable multifunction device 100, the display is touch-sensitive display system 112, and the touch-sensitive surface includes contact intensity sensors 165 on the display (Figure 1A). For convenience of explanation, the embodiments described with reference to Figures 11C-11U will be discussed with reference to display 450 and a separate touch-sensitive surface 451. However, analogous operations are, optionally, performed on a device with a touch-sensitive display system 112 in response to detecting the contacts described in Figures 11C-11U on the touch-sensitive display system 112 while displaying the user interfaces shown in Figures 11C-11U on the touch-sensitive display system 112; in such embodiments, the focus selector is, optionally: a respective contact, a representative point corresponding to a contact (e.g., a centroid of a respective contact or a point associated with a respective contact), or a centroid of two or more contacts detected on the touch-sensitive display system 112, in place of cursor 13536.

[00243] Figures 11M-11U illustrate another example of adjusting the progress of an animation in accordance with intensity of a contact. Figure 11M illustrates user interface 13544, including files icon 13546, displayed on display 450 of a device (e.g., device 300). Figure 11M further illustrates contact 13548 detected on touch-sensitive surface 451, intensity of contact 13548 below IT_L, intensity sensors 13538, and additional dynamic range 13550 corresponding to the relative location of contact 13548 on touch-sensitive surface 451 and intensity sensors 13538. Figures 11N-11Q illustrate an animation displaying the files associated with files icon 13546 progressing in accordance with a first input-output relationship as intensity of contact 13548 increases from IT_L to just below IT_D. Figure 11R illustrates a transition point in the animation progress as intensity of contact 13548 reaches IT_D. Figures 11S-11U illustrate the animation progressing in accordance with a second input-output relationship as intensity of contact 13548 increases beyond IT_D.

[00244] Figures 12A-12D are flow diagrams illustrating method 13600 of adjusting outputs with changes in contact intensity and varying dynamic range of intensity detection in accordance with some embodiments. Method 13600 is performed at an electronic device (e.g., device 300, Figure 3, or portable multifunction device 100, Figure 1A) with a display and a touch-sensitive surface. In some embodiments, the display is a touch screen display and

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the touch-sensitive surface is on the display. In some embodiments, the display is separate from the touch-sensitive surface. Some operations in method 13600 are, optionally, combined and/or the order of some operations is, optionally, changed.

[00245] As described below, method 13600 provides an intuitive way to adjust user interface outputs with changes in contact intensity and in accordance with a dynamic input range that varies according to location of the contact. The method reduces the cognitive burden on a user when navigating user interface hierarchies, thereby creating a more efficient human-machine interface. For battery-operated electronic devices, enabling a user to navigate user interface hierarchies faster and more efficiently, while adjusting outputs with changes in contact intensity and varying dynamic range of intensity detection, conserves power and increases the time between battery charges.

[00246] The device detects (13602) a contact (e.g., a finger contact) on the touch-sensitive surface. For example, in Figure 11B the device detects contact 13524 on touch-sensitive display 13518.

[00247] The device determines (13604) a respective location of the contact on the touch-sensitive surface (e.g., a current (x,y) position of a representative point in the contact, such as the centroid of the contact), where the respective location on the touch-sensitive surface has a respective dynamic range for detecting intensity of the contact. For example, the device in Figure 11B determines the location of contact 13524 and corresponding additional intensity range 13526.

[00248] In some embodiments, the device determining a respective dynamic range for the respective location includes (13606) retrieving stored information concerning the dynamic range of the device for detecting intensity of the contact at the respective location (e.g., information that was previously stored at the device or at a remote computer system). For example, in these embodiments, the device in Figure 11B retrieves stored information concerning additional dynamic range 13526 corresponding to the location of contact 13524.

[00249] The device determines (13608) an intensity of the contact on the touch-sensitive surface at the respective location. In some embodiments, determining the intensity of the contact on the touch-sensitive surface includes making a plurality of measurements of the intensity of the contact over time so as to detect changes in the intensity of the contact over time. For example, the device in Figure 11B determines intensity of contact 13524.

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[00250] In some embodiments, the sensors to detect intensity of contacts with the touch-sensitive surface include (13610) a plurality of intensity sensors placed around a perimeter of the touch-sensitive surface (e.g., the intensity sensors are located proximate to the corners of a trackpad) and locations near the perimeter of the touch-sensitive surface have a lower dynamic range than locations near a center of the touch-sensitive surface. For example, the device in Figure 11C includes intensity sensors 13538 located proximate to the corners of touch-sensitive surface 451.

[00251] The device detects (13612) a change in intensity of the contact. In some embodiments, the change in intensity of the contact is detected while the contact remains at the respective location. For example, Figures 11C-11D illustrate a device detecting contact 13540 on touch-sensitive surface 451 and an increase in intensity of contact 13540 from below IT_L in Figure 11C to IT_L in Figure 11D.

[00252] In response to detecting the change in intensity of the contact at the respective location on the touch-sensitive surface, the device adjusts (13614) an output. For example, in Figures 11C-11L the device adjusts an animation progression of files associated with files icon 13534.

[00253] In accordance with a determination that the respective location has (13616) a first dynamic range, the output is adjusted in accordance with the change in the intensity of the contact at the respective location and a first input-output mapping of intensity to response that corresponds to the first dynamic range. For example, in Figures 11C-11L the device adjusts an animation progression of files associated with files icon 13534. Figures 11C-11J further illustrate the location of contact 13540 on touch-sensitive surface 451 and corresponding additional dynamic range 13542. In this example, the animation progresses in accordance with changes in intensity of contact 13540 and an input-output mapping corresponding to additional dynamic range 13542.

[00254] Conversely, in accordance with a determination that the respective location has (13618) a second dynamic range that is different from the first dynamic range, the output is adjusted in accordance with the change in the intensity of the contact at the respective location and a second input-output mapping of intensity to response that corresponds to the second dynamic range, where the second input-output mapping is different from the first input-output mapping. For example, in Figures 11M-11U the device adjusts an animation progression of files associated with files icon 13546. Figures 11M-11U further illustrate the

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location of contact 13548 on touch-sensitive surface 451 and corresponding additional dynamic range 13550, which is different from additional dynamic range 13542 in Figure 11C. In this example, the animation progresses in accordance with changes in intensity of contact 13548 and an input-output mapping corresponding to additional dynamic range 13550.

[00255] In some embodiments, the second dynamic range is higher (13620) than the first dynamic range (e.g., the second dynamic range includes a larger range of intensity values than the first dynamic range) and the second input-output mapping maps intensity to output values for one or more intensity values that are outside of the first dynamic range (e.g., the second dynamic range includes a maximum detectable intensity that is higher than the maximum detectable intensity of the first dynamic range). For example, in Figure 11B the device detects contact 13524 at a first location with corresponding additional dynamic range 13526 and contact 13528 at a second location with corresponding additional dynamic range 13530. In this example, contact 13528 at the second location has a larger dynamic range that includes multiple intensity values, which are outside of the dynamic range associated with the location of contact 13524.

[00256] In some embodiments, an upper bound of the first dynamic range is determined (13622) based on a first intensity that corresponds to a first intensity detection limit at a first location on the touch-sensitive surface and an upper bound of the second dynamic range is determined based on a second intensity, different from the first intensity, that corresponds to a second intensity detection limit at a second location, different from the first location, on the touch-sensitive surface. In some embodiments, the first intensity detection limit is determined based on an actual, theoretical or estimated intensity that is a maximum intensity that the device is capable of detecting at the first location. In some embodiments, the second intensity detection limit is determined based on an actual, theoretical or estimated intensity that is a maximum intensity that the device is capable of detecting at the second location. In these embodiments, for example, in Figure 11B additional dynamic range 13526 corresponds to a first intensity detection limit associated with the location of contact 13524 and additional dynamic range 13530 corresponds to a second intensity detection limit associated with the location of contact 13528.

[00257] In some embodiments, the first input-output mapping asymptotically approaches (13624) a respective maximum output as the device detects intensity values close to the first intensity (e.g., the upper bound of the first dynamic range) and the second input-

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output mapping asymptotically approaches the respective (e.g., the same respective) maximum output as the device detects intensity values close to the second intensity (e.g., the upper bound of the second dynamic range). In some embodiments, both input-output mappings approach a same final animation state at a maximum detectable intensity, but the maximum detectable intensities of the input-output mappings are different. Thus, the device reaches the final animation state at the first location at an intensity that is different from the intensity at which the device reaches the final animation state at the second location. For example, Figure 11A illustrates first input-output mapping 13501 with max response value 13508 and second input-output mapping 13509 with max response value 13516. Figure 11A further illustrates the output response in first input-output mapping 13501 asymptotically approaching max response value 13508 and the output response in second input-output mapping 13509 asymptotically approaching max response value 13516. In this example, and in these embodiments, max response value 13508 is the same as max response value 13516.

[00258] In some embodiments, the first input-output mapping maps (13626) a first range of intensity values to a respective range of output and the second input-output mapping maps a second range of intensity values, different from the first range of intensity values, to the respective range (e.g., the same respective range) of output. For example, at the first location 0-500g of force is mapped to a predefined range of output values (e.g., 0-130% animation progression), and at the second location 0-2000g of force is mapped to the same predefined range of output values (e.g., 0-130% animation progression). In these embodiments, for example, the animation progression illustrated in Figures 11C-11J corresponds to a first input-output mapping and the animation progression illustrated in Figures 11M-11U corresponds to a second input-output mapping. In this example, and in these embodiments, the animation progression illustrated in Figures 11C-11J corresponds to the same respective output range as the animation progression illustrated in Figures 11M-11U.

[00259] In some embodiments, the first input-output mapping has (13628) a first portion (e.g., a linear response portion) that corresponds to a range of intensity values below a transition intensity value and a second portion (e.g., a non-linear response portion) that corresponds to a range of intensity values above the transition intensity value. In some implementations, the second input-output mapping has a first portion (e.g., a linear response portion) that corresponds to a range of intensity values below the transition intensity value and a second portion (e.g., a non-linear response portion) that corresponds to a range of

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intensity values above the transition intensity value. In some implementations, the first portion of the first input-output mapping is the same as the first portion of the second input-output mapping (e.g., linear portion) and the second portion of the first input-output mapping is different from the second portion of the second input-output mapping (e.g., cubic portion). For example, Figure 11A shows first input-output mapping 13501 including first range of intensity values 13502 (e.g., a linear portion) corresponding to intensities between IT_L and IT_D and second range of intensity values 13506 (e.g., a non-linear portion) corresponding to intensities between IT_D and IT_{MAX1}. Figure 11A further shows second input-output mapping 13509 including first range of intensity values 13510 corresponding to intensities between IT_L and IT_D and second range of intensity values 13514 corresponding to intensities between IT_D and IT_{MAX2}. It is noted that that IT_{MAX2} is different from IT_{MAX1}, and in this example represents a higher intensity value than IT_{MAX1}. In accordance with these embodiments, first range of intensity values 13502 in first input-output mapping 13501 is the same as first range of intensity values 13510 in second input-output mapping 13509 and second range of intensity values 13506 in first input-output mapping 13501 is different from second range of intensity values 13514 in second input-output mapping 13509.

[00260] In some embodiments, adjusting the output of the device includes (13630), in accordance with a determination that a maximum intensity of the contact is below the transition intensity value, generating (13632) a same output in accordance with the maximum intensity of the contact without regard to whether the respective location has the first dynamic range or the second dynamic range and, in accordance with a determination that a maximum intensity of the contact is above the transition intensity value, generating (13634) different outputs in accordance with the maximum intensity of the contact and whether the respective location has the first dynamic range or the second dynamic range (e.g., when the respective location has the first dynamic range, the device generates a first output, and when the respective location has the second dynamic range, the device generates a second output different from the first output). For example, if the device detected two substantially identical press inputs at two different locations on the touch-sensitive surface (e.g., a first location with a first dynamic range and a second location with the second dynamic range, with the two inputs detected at different times), the device produces outputs that depend at least in part on the dynamic range of the locations and whether the intensity of the contact is above the transition intensity. In this example, when the inputs are below the transition intensity, the device produces substantially identical outputs at the two locations, but, when the inputs are

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above the transition intensity, the device produces different outputs at the two locations even if the two inputs are substantially identical. Thus, in this example, the differences in the output, due to differing dynamic range of the location of the press input, are confined to the range of intensities above the transition intensity. Consequently, in this example, the device maintains a consistent the user experience across the touch-sensitive surface for inputs with intensities below the transition intensity while also taking advantage of increased dynamic range of some portions of the touch-sensitive surface (e.g., the center of the touch-sensitive surface, an locations near the center (e.g., within a predefined distance of the center, or within a predefined window around the center) of the touch-sensitive surface), to provide additional feedback to the user.

[00261] In some embodiments, while adjusting output of the device in accordance with the first input-output mapping, the device detects (13636) movement of the contact from a first location on the touch-sensitive surface with the first dynamic range to a second location on the touch-sensitive surface with the second dynamic range and, in response to detecting the movement of the contact from the first location to the second location, the device continues (13638) to use the first input-output mapping to adjust the output of the device while the contact is at the second location. In these embodiments, the animation illustrated in Figures 11C-11J is unchanged by subsequent movement of contact 13540.

[00262] Conversely, in some embodiments, while adjusting output of the device in accordance with the first input-output mapping, the device detects (13640) movement of the contact from a first location on the touch-sensitive surface with the first dynamic range to a second location on the touch-sensitive surface with the second dynamic range and, in response to detecting the movement of the contact from the first location to the second location, the device uses (13642) the second input-output mapping to adjust the output of the device while the contact is at the second location. In some embodiments, there is a smooth transition between the first input-output mapping and the second input-output mapping, so that, if the intensity of the contact is maintained at a respective intensity, the output gradually changes as the contact moves from the first location to the second location. In these embodiments, the animation illustrated in Figures 11C-11J is adjusted in accordance with the dynamic range corresponding to the location of contact 13540 resulting from subsequent movement of contact 13540.

[00263] It should be understood that the particular order in which the operations in Figures 12A-12D have been described is merely exemplary and is not intended to indicate

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that the described order is the only order in which the operations could be performed. One of ordinary skill in the art would recognize various ways to reorder the operations described herein. Additionally, it should be noted that details of other processes described herein with respect to other methods described herein (e.g., those listed in paragraph [0045]) are also applicable in an analogous manner to method 13600 described above with respect to Figures 12A-12D. For example, the contacts, gestures, user interface objects, intensity thresholds, focus selectors, outputs, and animations described above with reference to method 13600 optionally have one or more of the characteristics of the contacts, gestures, user interface objects, intensity thresholds, focus selectors, outputs, and animations described herein with reference to other methods described herein (e.g., those listed in paragraph [0045]]). For brevity, these details are not repeated here.

[00264] In accordance with some embodiments, Figure 13 shows a functional block diagram of an electronic device 13700 configured in accordance with the principles of the various described embodiments. The functional blocks of the device are, optionally, implemented by hardware, software, or a combination of hardware and software to carry out the principles of the various described embodiments. It is understood by persons of skill in the art that the functional blocks described in Figure 13 are, optionally, combined or separated into sub-blocks to implement the principles of the various described embodiments. Therefore, the description herein optionally supports any possible combination or separation or further definition of the functional blocks described herein.

[00265] As shown in Figure 13, electronic device 13700 includes display unit 13702, touch-sensitive surface unit 13704 configured to receive user contacts, one or more sensor units 13705 configured to detect intensity of contacts with the touch-sensitive surface unit, and processing unit 13706 coupled to display unit 13702, touch-sensitive surface unit 13704, and sensor units 13705. In some embodiments, processing unit 13706 includes location detecting unit 13708, contact intensity detecting unit 13709, determining unit 13710, and adjusting unit 13712.

[00266] Processing unit 13706 is configured to detect (e.g., with contact intensity detecting unit 13709) a contact on touch-sensitive surface unit 13704, determine (e.g., with determining unit 13710) a respective location of the contact on touch-sensitive surface unit 13704, where the respective location on touch-sensitive surface unit 13704 has a respective dynamic range for detecting intensity of the contact. Processing unit 13706 is further configured to determine (e.g., with determining unit 13710) an intensity of the contact on

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touch-sensitive surface unit 13704 at the respective location and detect (e.g., with contact intensity detecting unit 13709) a change in intensity of the contact. Processing unit 13706 is further configured to, in response to detecting the change in intensity of the contact at the respective location on touch-sensitive surface 13704, adjust (e.g., with adjusting unit 13712) an output of the device, where, in accordance with a determination that the respective location has a first dynamic range, the output is adjusted in accordance with the change in the intensity of the contact at the respective location and a first input-output mapping of intensity to response that corresponds to the first dynamic range, and, in accordance with a determination that the respective location has a second dynamic range that is different from the first dynamic range, the output is adjusted in accordance with the change in the intensity of the contact at the respective location and a second input-output mapping of intensity to response that corresponds to the second dynamic range, where the second input-output mapping is different from the first input-output mapping.

[00267] In some embodiments, the device determines (e.g., with determining unit 13710) a respective dynamic range for the respective location includes retrieving stored information concerning the dynamic range of the device for detecting intensity of the contact at the respective location.

[00268] In some embodiments, the second dynamic range is higher than the first dynamic range and the second input-output mapping maps intensity to output values for one or more intensity values that are outside of the first dynamic range.

[00269] In some embodiments, an upper bound of the first dynamic range is determined (e.g., with determining unit 13710) based on a first intensity that corresponds to a first intensity detection limit at a first location on touch-sensitive surface unit 13704 and an upper bound of the second dynamic range is determined (e.g., with determining unit 13710) based on a second intensity, different from the first intensity, that corresponds to a second intensity detection limit at a second location, different from the first location, on touch-sensitive surface unit 13704.

[00270] In some embodiments, the first input-output mapping asymptotically approaches a respective maximum output as the device detects (e.g., with contact intensity detecting unit 13709) intensity values close to the first intensity and the second input-output mapping asymptotically approaches the respective maximum output as the device detects

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(e.g., with contact intensity detecting unit 13709) intensity values close to the second intensity.

[00271] In some embodiments, the first input-output mapping maps a first range of intensity values to a respective range of output and the second input-output mapping maps a second range of intensity values, different from the first range of intensity values, to the respective range of output.

[00272] In some embodiments, the first input-output mapping has a first portion that corresponds to a range of intensity values below a transition intensity value and a second portion that corresponds to a range of intensity values above the transition intensity value, the second input-output mapping has a first portion that corresponds to a range of intensity values below the transition intensity value and a second portion that corresponds to a range of intensity values above the transition intensity value, the first portion of the first input-output mapping is the same as the first portion of the second input-output mapping, and the second portion of the first input-output mapping is different from the second portion of the second input-output mapping.

[00273] In some embodiments, adjusting (e.g., with adjusting unit 13712) the output of the device includes, in accordance with a determination that a maximum intensity of the contact is below the transition intensity value, generating a same output in accordance with the maximum intensity of the contact without regard to whether the respective location has the first dynamic range or the second dynamic range and, in accordance with a determination that a maximum intensity of the contact is above the transition intensity value, generating different outputs in accordance with the maximum intensity of the contact and whether the respective location has the first dynamic range or the second dynamic range.

[00274] In some embodiments, sensors units 13705 configured to detect intensity of contacts with touch-sensitive surface unit 13704 include a plurality of intensity sensors placed around a perimeter of touch-sensitive surface unit 13704 and locations near the perimeter of touch-sensitive surface unit 13704 have a lower dynamic range than locations near a center of touch-sensitive surface unit 13704.

[00275] In some embodiments, processing unit 13706 is further configured to, while adjusting (e.g., with adjusting unit 13712) output of the device in accordance with the first input-output mapping, detect (e.g., with location detecting unit 13708) movement of the contact from a first location on touch-sensitive surface unit 13704 with the first dynamic

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range to a second location on touch-sensitive surface unit 13704 with the second dynamic range and, in response to detecting the movement of the contact from the first location to the second location, continue to use the first input-output mapping to adjust (e.g., with adjusting unit 13712) the output of the device while the contact is at the second location.

[00276] In some embodiments, processing unit 13706 is further configured to, while adjusting (e.g., with adjusting unit 13712) output of the device in accordance with the first input-output mapping, detect (e.g., with location detecting unit 13708) movement of the contact from a first location on touch-sensitive surface unit 13704 with the first dynamic range to a second location on touch-sensitive surface unit 13704 with the second dynamic range and, in response to detecting the movement of the contact from the first location to the second location, use the second input-output mapping to adjust (e.g., with adjusting unit 13712) the output of the device while the contact is at the second location.

[00277] The operations in the information processing methods described above are, optionally, implemented by running one or more functional modules in information processing apparatus such as general purpose processors (e.g., as described above with respect to Figures 1A and 3) or application specific chips.

[00278] The operations described above with reference to Figures 12A-12D are, optionally, implemented by components depicted in Figures 1A-1B or Figure 13. For example, detection operations 13602, 13612, 13636, and 13640, determining operations 13604 and 13608, and adjusting operation 13614 are, optionally, implemented by event sorter 170, event recognizer 180, and event handler 190. Event monitor 171 in event sorter 170 detects a contact on touch-sensitive display 112, and event dispatcher module 174 delivers the event information to application 136-1. A respective event recognizer 180 of application 136-1 compares the event information to respective event definitions 186, and determines whether a first contact at a first location on the touch-sensitive surface corresponds to a predefined event or sub-event, such as selection of an object on a user interface. When a respective predefined event or sub-event is detected, event recognizer 180 activates an event handler 190 associated with the detection of the event or sub-event. Event handler 190 optionally utilizes or calls data updater 176 or object updater 177 to update the application internal state 192. In some embodiments, event handler 190 accesses a respective GUI updater 178 to update what is displayed by the application. Similarly, it would be clear to a person having ordinary skill in the art how other processes can be implemented based on the components depicted in Figures 1A-1B.

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[00279] It should be understood that the particular order in which the operations have been described above is merely exemplary and is not intended to indicate that the described order is the only order in which the operations could be performed. One of ordinary skill in the art would recognize various ways to reorder the operations described herein. Additionally, it should be noted that the various processes separately described herein (e.g., those listed in paragraph [0045]) can be combined with each other in different arrangements. For example, the contacts, user interface objects, tactile sensations, intensity thresholds, and/or focus selectors described above with reference to any one of the various processes separately described herein (e.g., those listed in paragraph [0045]) optionally have one or more of the characteristics of the contacts, gestures, user interface objects, tactile sensations, intensity thresholds, and focus selectors described herein with reference to one or more of the other methods described herein (e.g., those listed in paragraph [0045]). For brevity, all of the various possible combinations are not specifically enumerated here, but it should be understood that the claims described above may be combined in any way that is not precluded by mutually exclusive claim features.

[00280] The foregoing description, for purpose of explanation, has been described with reference to specific embodiments. However, the illustrative discussions above are not intended to be exhaustive or to limit the various described embodiments to the precise forms disclosed. Many modifications and variations are possible in view of the above teachings. The embodiments were chosen and described in order to best explain the principles of the various described embodiments and their practical applications, to thereby enable others skilled in the art to best utilize the various described embodiments with various modifications as are suited to the particular use contemplated.

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What is claimed is:

1. A method, comprising:

at an electronic device with a touch-sensitive surface and a display, wherein the device includes one or more sensors to detect intensity of contacts with the touch-sensitive surface:

detecting a contact on the touch-sensitive surface;

determining a location of the contact on the touch-sensitive surface;

determining an intensity of the contact on the touch-sensitive surface; and

displaying a response in accordance with the detected contact, the response being based at least in part on an input-output mapping of intensity to response at the location of the contact on the touch-sensitive surface, the input-output mapping including, for a respective location on the touch-sensitive surface:

a first input-output relationship between intensity and response over a first range of intensity values;

a second input-output relationship between intensity and response over a second range of intensity values, the second range of intensity values being different from the first range of intensity values; and

a transitional intensity value where the first range of intensity values meets or overlaps the second range of intensity values, wherein, at the transitional intensity value:

the first input-output relationship has a first rate of change of response with change in intensity;

the second input-output relationship has a second rate of change of response with change in intensity; and

the first rate of change is substantially the same as the second rate of change.

2. The method of claim 1, wherein, the second input-output relationship and the first input-output relationship have a same output at the transitional intensity value.

3. The method of any of claims 1-2, wherein the first input-output relationship is linear.

4. The method of any of claims 1-3, wherein the second input-output relationship is non-linear.

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5. The method of any of claims 1-4, wherein the second input-output relationship asymptotically approaches a maximum output as intensity of the contact increases above the transition intensity value.

6. The method of any of claims 1-5, including, displaying a user interface that includes a plurality of user interface objects, wherein:

the plurality of user interface objects respond to press inputs having intensity above corresponding activation intensity thresholds; and

a respective activation intensity threshold for two or more of the user interface objects is the same as the transitional intensity value.

7. The method of any of claims 1-6, wherein:

a first property of the device varies at different locations on the touch-sensitive surface;

the first input-output relationship is the same at a first location and a second location on the touch-sensitive surface; and

the second input-output relationship is different at the first location than at the second location on the touch-sensitive surface.

8. The method of any of claims 1-7, wherein the response includes changing a current value of a property from a first value to a second value in a predefined range of values.

9. The method of any of claims 1-8, wherein the response includes adjusting one or more of: volume, brightness, user interface object spacing, user interface object size, user interface object opacity, content scrubbing, and animation progress.

10. An electronic device, comprising:

a display;

a touch-sensitive surface;

one or more sensors to detect intensity of contacts with the touch-sensitive surface;

one or more processors;

memory; and

one or more programs, wherein the one or more programs are stored in the memory and configured to be executed by the one or more processors, the one or more programs including instructions for:

detecting a contact on the touch-sensitive surface;

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determining a location of the contact on the touch-sensitive surface;

determining an intensity of the contact on the touch-sensitive surface; and

displaying a response in accordance with the detected contact, the response being based at least in part on an input-output mapping of intensity to response at the location of the contact on the touch-sensitive surface, the input-output mapping including, for a respective location on the touch-sensitive surface:

a first input-output relationship between intensity and response over a first range of intensity values;

a second input-output relationship between intensity and response over a second range of intensity values, the second range of intensity values being different from the first range of intensity values; and

a transitional intensity value where the first range of intensity values meets or overlaps the second range of intensity values, wherein, at the transitional intensity value:

the first input-output relationship has a first rate of change of response with change in intensity;

the second input-output relationship has a second rate of change of response with change in intensity; and

the first rate of change is substantially the same as the second rate of change.

11. A computer readable storage medium storing one or more programs, the one or more programs comprising instructions, which when executed by an electronic device with a display, a touch-sensitive surface and one or more sensors to detect intensity of contacts with the touch-sensitive surface, cause the device to:

detect a contact on the touch-sensitive surface;

determine a location of the contact on the touch-sensitive surface;

determine an intensity of the contact on the touch-sensitive surface; and

display a response in accordance with the detected contact, the response being based at least in part on an input-output mapping of intensity to response at the location of the contact on the touch-sensitive surface, the input-output mapping including, for a respective location on the touch-sensitive surface:

a first input-output relationship between intensity and response over a first range of intensity values;

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a second input-output relationship between intensity and response over a second range of intensity values, the second range of intensity values being different from the first range of intensity values; and

a transitional intensity value where the first range of intensity values meets or overlaps the second range of intensity values, wherein, at the transitional intensity value:

the first input-output relationship has a first rate of change of response with change in intensity;

the second input-output relationship has a second rate of change of response with change in intensity; and

the first rate of change is substantially the same as the second rate of change.

12. A graphical user interface on an electronic device with a display, a touch-sensitive surface and one or more sensors to detect intensity of contacts with the touch-sensitive surface, a memory, and one or more processors to execute one or more programs stored in the memory, the graphical user interface comprising:

one or more user interface objects;

wherein:

in response to a contact being detected on the touch-sensitive surface:

a location of the contact on the touch-sensitive surface is determined;

an intensity of the contact on the touch-sensitive surface is determined; and

a response is displayed, corresponding to a change in one or more user interface objects that are displayed as part of the graphical user interface, in accordance with the detected contact, the response being based at least in part on an input-output mapping of intensity to response at the location of the contact on the touch-sensitive surface, the input-output mapping including, for a respective location on the touch-sensitive surface:

a first input-output relationship between intensity and response over a first range of intensity values;

a second input-output relationship between intensity and response over a second range of intensity values, the second range of intensity values being different from the first range of intensity values; and

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a transitional intensity value where the first range of intensity values meets or overlaps the second range of intensity values, wherein, at the transitional intensity value:

the first input-output relationship has a first rate of change of response with change in intensity;

the second input-output relationship has a second rate of change of response with change in intensity; and

the first rate of change is substantially the same as the second rate of change.

13. An electronic device, comprising:

a display;

a touch-sensitive surface;

one or more sensors to detect intensity of contacts with the touch-sensitive surface; and

means for detecting a contact on the touch-sensitive surface;

means for determining a location of the contact on the touch-sensitive surface;

means for determining an intensity of the contact on the touch-sensitive surface; and

means for displaying a response in accordance with the detected contact, the response being based at least in part on an input-output mapping of intensity to response at the location of the contact on the touch-sensitive surface, the input-output mapping including, for a respective location on the touch-sensitive surface:

a first input-output relationship between intensity and response over a first range of intensity values;

a second input-output relationship between intensity and response over a second range of intensity values, the second range of intensity values being different from the first range of intensity values; and

a transitional intensity value where the first range of intensity values meets or overlaps the second range of intensity values, wherein, at the transitional intensity value:

the first input-output relationship has a first rate of change of response with change in intensity;

the second input-output relationship has a second rate of change of response with change in intensity; and

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the first rate of change is substantially the same as the second rate of change.

14. An information processing apparatus for use in an electronic device with a display, a touch-sensitive surface and one or more sensors to detect intensity of contacts with the touch-sensitive surface, comprising:

means for detecting a contact on the touch-sensitive surface;

means for determining a location of the contact on the touch-sensitive surface;

means for determining an intensity of the contact on the touch-sensitive surface; and

means for displaying a response in accordance with the detected contact, the response being based at least in part on an input-output mapping of intensity to response at the location of the contact on the touch-sensitive surface, the input-output mapping including, for a respective location on the touch-sensitive surface:

a first input-output relationship between intensity and response over a first range of intensity values;

a second input-output relationship between intensity and response over a second range of intensity values, the second range of intensity values being different from the first range of intensity values; and

a transitional intensity value where the first range of intensity values meets or overlaps the second range of intensity values, wherein, at the transitional intensity value:

the first input-output relationship has a first rate of change of response with change in intensity;

the second input-output relationship has a second rate of change of response with change in intensity; and

the first rate of change is substantially the same as the second rate of change.

15. An electronic device, comprising:

a display;

a touch-sensitive surface;

one or more sensors to detect intensity of contacts with the touch-sensitive surface;

one or more processors;

memory; and

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one or more programs, wherein the one or more programs are stored in the memory and configured to be executed by the one or more processors, the one or more programs including instructions for performing any of the methods of claims 1-9.

16. A computer readable storage medium storing one or more programs, the one or more programs comprising instructions, which when executed by an electronic device with a display, a touch-sensitive surface and one or more sensors to detect intensity of contacts with the touch-sensitive surface, cause the device to perform any of the methods of claims 1-9.

17. A graphical user interface on an electronic device with a display, a touch-sensitive surface, one or more sensors to detect intensity of contacts with the touch-sensitive surface, a memory, and one or more processors to execute one or more programs stored in the memory, the graphical user interface comprising user interfaces displayed in accordance with any of the methods of claims 1-9.

18. An electronic device, comprising:

a display;

a touch-sensitive surface;

one or more sensors to detect intensity of contacts with the touch-sensitive surface; and

means for performing any of the methods of claims 1-9.

19. An information processing apparatus for use in an electronic device with a display, a touch-sensitive surface and one or more sensors to detect intensity of contacts with the touch-sensitive surface, comprising:

means for performing any of the methods of claims 1-9.

20. An electronic device, comprising:

a display unit configured to display a response in accordance with a detected contact;

a touch-sensitive surface unit configured to receive user contacts;

one or more sensor units configured to detect intensity of contacts with the touch-sensitive surface unit; and

a processing unit coupled to the display unit, the touch-sensitive surface unit, and the sensor units, the processing unit configured to:

detect a contact on the touch-sensitive surface unit;

determine a location of the contact on the touch-sensitive surface unit;

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determine an intensity of the contact on the touch-sensitive surface unit; and

enable display of a response in accordance with the detected contact, the response being based at least in part on an input-output mapping of intensity to response at the location of the contact on the touch-sensitive surface unit, the input-output mapping including, for a respective location on the touch-sensitive surface unit:

a first input-output relationship between intensity and response over a first range of intensity values;

a second input-output relationship between intensity and response over a second range of intensity values, the second range of intensity values being different from the first range of intensity values; and

a transitional intensity value where the first range of intensity values meets or overlaps the second range of intensity values, wherein, at the transitional intensity value:

the first input-output relationship has a first rate of change of response with change in intensity;

the second input-output relationship has a second rate of change of response with change in intensity; and

the first rate of change is substantially the same as the second rate of change.

21. The electronic device of claim 20, wherein, the second input-output relationship and the first input-output relationship have a same output at the transitional intensity value.

22. The electronic device of any of claims 20-21, wherein the first input-output relationship is linear.

23. The electronic device of any of claims 20-22, wherein the second input-output relationship is non-linear.

24. The electronic device of any of claims 20-23, wherein the second input-output relationship asymptotically approaches a maximum output as intensity of the contact increases above the transition intensity value.

25. The electronic device of any of claims 20-24, the processing unit further configured to enable display of a user interface that includes a plurality of user interface objects, wherein:

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the plurality of user interface objects respond to press inputs having an intensity above corresponding activation intensity thresholds; and

a respective activation intensity threshold for two or more of the user interface objects is the same as the transitional intensity value.

26. The electronic device of any of claims 20-25, wherein:

a first property of the device varies at different locations on the touch-sensitive surface unit;

the first input-output relationship is the same at a first location and a second location on the touch-sensitive surface unit; and

the second input-output relationship is different at the first location than at the second location on the touch-sensitive surface unit.

27. The electronic device of any of claims 20-26, wherein the response includes changing a current value of a property from a first value to a second value in a predefined range of values.

28. The electronic device of any of claims 20-27, wherein the response includes adjusting one or more of: volume, brightness, user interface object spacing, user interface object size, user interface object opacity, content scrubbing, and animation progress.

29. A method, comprising:

at an electronic device with a display and a touch-sensitive surface, wherein the device includes a plurality of intensity sensors to detect intensity of contacts with the touch-sensitive surface:

detecting, on the touch-sensitive surface, a plurality of contacts;

while detecting the plurality of contacts:

receiving a first intensity measurement from a first intensity sensor of the plurality of intensity sensors;

receiving a second intensity measurement from a second intensity sensor of the plurality of intensity sensors, wherein the first intensity sensor is different from the second intensity sensor;

assigning a first portion of an aggregate intensity of the contacts to the first contact and assigning a second portion of the aggregate intensity to the second contact based at least in part on:

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the first intensity measurement;

the second intensity measurement;

a location of the first intensity sensor relative to the touch-sensitive surface;

a location of the second intensity sensor relative to the touch-sensitive surface; and

a comparison between values of a set of one or more properties of the first contact and corresponding values of the set of one or more properties of the second contact; and

in response to detecting the plurality of contacts, performing an operation based at least in part on the portion of the aggregate intensity assigned to the first contact.

30. The method of claim 29, wherein the operation is based at least in part on the portion of the aggregate intensity assigned to the second contact.

31. The method of any of claims 29-30, wherein the device includes a number of intensity sensor units, and the number of detected contacts is greater than the number of intensity sensors.

32. The method of any of claims 29-30, wherein:

the device includes a number of intensity sensors;

the aggregate intensity is divided between a number of detected contacts; and

the number of detected contacts is greater than the number of intensity sensors.

33. The method of any of claims 29-32, wherein:

the plurality of intensity sensors define a perimeter on the device; and

the plurality of contacts are detected within the perimeter defined by the plurality of intensity sensors.

34. The method of any of claims 29-33, wherein the plurality of intensity sensors includes at least four intensity sensors.

35. The method of any of claims 29-34, wherein:

the touch-sensitive surface has a plurality of respective corners; and

each respective intensity sensor of the plurality of intensity sensors is positioned proximate to a corresponding respective corner.

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36. The method of any of claims 29-35, wherein the set of one or more properties for a respective contact includes a location of the respective contact on the touch-sensitive surface.

37. The method of any of claims 29-36, wherein the set of one or more properties of a respective contact includes a contact size of the respective contact on the touch-sensitive surface.

38. The method of any of claims 29-37, including determining a center of force on the touch-sensitive surface based at least in part on:

the location of the first intensity sensor relative to the touch-sensitive surface;

the location of the second intensity sensor relative to the touch-sensitive surface;

the first intensity measurement of the first intensity sensor; and

the second intensity measurement of the second intensity sensor.

39. The method of claim 38, wherein determining the center of force includes:

identifying one or more incidental contacts on the touch-sensitive surface; and

compensating for the presence of a respective incidental contact on the touch-sensitive surface.

40. The method of any of claims 38-39, including:

determining a location of the first contact relative to the center of force;

determining a location of the second contact relative to the center of force;

assigning the first portion of the aggregate intensity to the first contact based on the location of the first contact relative to the center of force; and

assigning the second portion of the aggregate intensity to the second contact based on the location of the second contact relative to the center of force.

41. An electronic device, comprising:

a display;

a touch-sensitive surface;

a plurality of intensity sensors to detect intensity of contacts with the touch-sensitive surface;

one or more processors;

memory; and

one or more programs, wherein the one or more programs are stored in the memory and configured to be executed by the one or more processors, the one or more programs including instructions for:

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detecting, on the touch-sensitive surface, a plurality of contacts;

while detecting the plurality of contacts:

receiving a first intensity measurement from a first intensity sensor of the plurality of intensity sensors;

receiving a second intensity measurement from a second intensity sensor of the plurality of intensity sensors, wherein the first intensity sensor is different from the second intensity sensor;

assigning a first portion of an aggregate intensity of the contacts to the first contact and assigning a second portion of the aggregate intensity to the second contact based at least in part on:

the first intensity measurement;

the second intensity measurement;

a location of the first intensity sensor relative to the touch-sensitive surface;

a location of the second intensity sensor relative to the touch-sensitive surface; and

a comparison between values of a set of one or more properties of the first contact and corresponding values of the set of one or more properties of the second contact; and

in response to detecting the plurality of contacts, performing an operation based at least in part on the portion of the aggregate intensity assigned to the first contact.

42. A computer readable storage medium storing one or more programs, the one or more programs comprising instructions, which when executed by an electronic device with a display, a touch-sensitive surface and a plurality of intensity sensors to detect intensity of contacts with the touch-sensitive surface, cause the device to:

detect, on the touch-sensitive surface, a plurality of contacts;

while detecting the plurality of contacts:

receive a first intensity measurement from a first intensity sensor of the plurality of intensity sensors;

receive a second intensity measurement from a second intensity sensor of the plurality of intensity sensors, wherein the first intensity sensor is different from the second intensity sensor;

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assign a first portion of an aggregate intensity of the contacts to the first contact and assign a second portion of the aggregate intensity to the second contact based at least in part on:

the first intensity measurement;

the second intensity measurement;

a location of the first intensity sensor relative to the touch-sensitive surface;

a location of the second intensity sensor relative to the touch-sensitive surface; and

a comparison between values of a set of one or more properties of the first contact and corresponding values of the set of one or more properties of the second contact; and

in response to detecting the plurality of contacts, perform an operation based at least in part on the portion of the aggregate intensity assigned to the first contact.

43. An electronic device, comprising:

a display;

a touch-sensitive surface;

a plurality of intensity sensors to detect intensity of contacts with the touch-sensitive surface; and

means for detecting, on the touch-sensitive surface, a plurality of contacts;

means for receiving a first intensity measurement from a first intensity sensor of the plurality of intensity sensors while the means for detecting detects the plurality of contacts;

means for receiving a second intensity measurement from a second intensity sensor of the plurality of intensity sensors while the means for detecting detects the plurality of contacts, wherein the first intensity sensor is different from the second intensity sensor;

means, responsive to detecting the plurality of contacts, for assigning, a first portion of an aggregate intensity of the contacts to the first contact and assigning a second portion of the aggregate intensity to the second contact based at least in part on:

the first intensity measurement;

the second intensity measurement;

a location of the first intensity sensor relative to the touch-sensitive surface;

a location of the second intensity sensor relative to the touch-sensitive surface; and

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a comparison between values of a set of one or more properties of the first contact and corresponding values of the set of one or more properties of the second contact; and

means, responsive to detecting the plurality of contacts, for performing an operation based at least in part on the portion of the aggregate intensity assigned to the first contact.

44. An information processing apparatus for use in an electronic device with a display, a touch-sensitive surface and a plurality of intensity sensors to detect intensity of contacts with the touch-sensitive surface, comprising:

means for detecting, on the touch-sensitive surface, a plurality of contacts;

means for receiving a first intensity measurement from a first intensity sensor of the plurality of intensity sensors while the means for detecting detects the plurality of contacts;

means for receiving a second intensity measurement from a second intensity sensor of the plurality of intensity sensors while the means for detecting detects the plurality of contacts, wherein the first intensity sensor is different from the second intensity sensor;

means, responsive to detecting the plurality of contacts, for assigning a first portion of an aggregate intensity of the contacts to the first contact and assigning a second portion of the aggregate intensity to the second contact based at least in part on:

the first intensity measurement;

the second intensity measurement;

a location of the first intensity sensor relative to the touch-sensitive surface;

a location of the second intensity sensor relative to the touch-sensitive surface; and

a comparison between values of a set of one or more properties of the first contact and corresponding values of the set of one or more properties of the second contact; and

means, responsive to detecting the plurality of contacts, for performing an operation based at least in part on the portion of the aggregate intensity assigned to the first contact.

45. An electronic device, comprising:

a display;

a touch-sensitive surface;

a plurality of intensity sensors to detect intensity of contacts with the touch-sensitive surface;

one or more processors;

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memory; and

one or more programs, wherein the one or more programs are stored in the memory and configured to be executed by the one or more processors, the one or more programs including instructions for performing any of the methods of claims 29-40.

46. A computer readable storage medium storing one or more programs, the one or more programs comprising instructions, which when executed by an electronic device with a display, a touch-sensitive surface and a plurality of intensity sensors to detect intensity of contacts with the touch-sensitive surface, cause the device to perform any of the methods of claims 29-40.

47. An electronic device, comprising:

a display;

a touch-sensitive surface;

a plurality of intensity sensors to detect intensity of contacts with the touch-sensitive surface; and

means for performing any of the methods of claims 29-40.

48. An information processing apparatus for use in an electronic device with a display, a touch-sensitive surface and a plurality of intensity sensors to detect intensity of contacts with the touch-sensitive surface, comprising:

means for performing any of the methods of claims 29-40.

49. An electronic device, comprising:

a display unit configured to display information;

a touch-sensitive surface unit configured to receive contacts;

a plurality of intensity sensor units to detect intensity of contacts with the touch-sensitive surface; and

a processing unit coupled to the display unit, the touch-sensitive surface unit and the plurality of intensity sensor units, the processing unit configured to:

detect, on the touch-sensitive surface unit, a plurality of contacts;

while detecting the plurality of contacts:

receive a first intensity measurement from a first intensity sensor unit of the plurality of intensity sensors unit;

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receive a second intensity measurement from a second intensity sensor unit of the plurality of intensity sensor units, wherein the first intensity sensor unit is different from the second intensity sensor unit;

assign a first portion of an aggregate intensity of the contacts to the first contact and assign a second portion of the aggregate intensity to the second contact based at least in part on:

the first intensity measurement;

the second intensity measurement;

a location of the first intensity sensor unit relative to the touch-sensitive surface unit;

a location of the second intensity sensor unit relative to the touch-sensitive surface unit; and

a comparison between values of a set of one or more properties of the first contact and corresponding values of the set of one or more properties of the second contact; and

in response to detecting the plurality of contacts, perform an operation based at least in part on the portion of the aggregate intensity assigned to the first contact.

50. The electronic device of claim 49, wherein the operation is based at least in part on the portion of the aggregate intensity assigned to the second contact.

51. The electronic device of any of claims 49-50, wherein the device includes a number of intensity sensor units, and the number of detected contacts is greater than the number of intensity sensor units.

52. The electronic device of any of claims 49-50, wherein:

the device includes a number of intensity sensor units;

the aggregate intensity is divided between a number of detected contacts; and

the number of detected contacts is greater than the number of intensity sensor units.

53. The electronic device of any of claims 49-52, wherein:

the plurality of intensity sensor units define a perimeter on the device; and

the plurality of contacts are detected within the perimeter defined by the plurality of intensity sensor units.

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54. The electronic device of any of claims 49-53, wherein the plurality of intensity sensor units includes at least four intensity sensor units.

55. The electronic device of any of claims 49-54, wherein:

the touch-sensitive surface unit has a plurality of respective corners; and

each respective intensity sensor unit of the plurality of intensity sensor units is positioned proximate to a corresponding respective corner.

56. The electronic device of any of claims 49-55, wherein the set of one or more properties for a respective contact includes a location of the respective contact on the touch-sensitive surface unit.

57. The electronic device of any of claims 49-56, wherein the set of one or more properties of a respective contact includes a contact size of the respective contact on the touch-sensitive surface unit.

58. The electronic device of any of claims 49-57, wherein the processing unit is further configured to determine a center of force on the touch-sensitive surface unit based at least in part on:

the location of the first intensity sensor unit relative to the touch-sensitive surface unit;

the location of the second intensity sensor unit relative to the touch-sensitive surface unit;

the first intensity measurement of the first intensity sensor unit; and

the second intensity measurement of the second intensity sensor unit.

59. The electronic device of claim 58, wherein determining the center of force includes:

identifying one or more incidental contacts on the touch-sensitive surface unit; and

compensating for the presence of a respective incidental contact on the touch-sensitive surface unit.

60. The electronic device of any of claims 58-59, wherein the processing unit is configured to:

determine a location of the first contact relative to the center of force;

determine a location of the second contact relative to the center of force;

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assign the first portion of the aggregate intensity to the first contact based on the location of the first contact relative to the center of force; and

assign the second portion of the aggregate intensity to the second contact based on the location of the second contact relative to the center of force.\

61. A method, comprising:

at an electronic device with a touch-sensitive surface and a display, wherein the device includes one or more sensors to detect intensity of contacts with the touch-sensitive surface:

detecting a contact on the touch-sensitive surface;

determining a respective location of the contact on the touch-sensitive surface, wherein the respective location on the touch-sensitive surface has a respective dynamic range for detecting intensity of the contact;

determining an intensity of the contact on the touch-sensitive surface at the respective location;

detecting a change in intensity of the contact; and

in response to detecting the change in intensity of the contact at the respective location on the touch-sensitive surface, adjusting an output of the device, wherein:

in accordance with a determination that the respective location has a first dynamic range, the output is adjusted in accordance with:

the change in the intensity of the contact at the respective location; and

a first input-output mapping of intensity to response that corresponds to the first dynamic range; and

in accordance with a determination that the respective location has a second dynamic range that is different from the first dynamic range, the output is adjusted in accordance with:

the change in the intensity of the contact at the respective location; and

a second input-output mapping of intensity to response that corresponds to the second dynamic range, wherein the second input-output mapping is different from the first input-output mapping.

62. The method of claim 61, wherein determining a respective dynamic range for the respective location includes retrieving stored information concerning the dynamic range of the device for detecting intensity of the contact at the respective location.

63. The method of any of claims 61-62, wherein:

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the second dynamic range is higher than the first dynamic range; and

the second input-output mapping maps intensity to output values for one or more intensity values that are outside of the first dynamic range.

64. The method of any of claims 61-63, wherein:

an upper bound of the first dynamic range is determined based on a first intensity that corresponds to a first intensity detection limit at a first location on the touch-sensitive surface; and

an upper bound of the second dynamic range is determined based on a second intensity, different from the first intensity, that corresponds to a second intensity detection limit at a second location, different from the first location, on the touch-sensitive surface.

65. The method of claim 64, wherein:

the first input-output mapping asymptotically approaches a respective maximum output as the device detects intensity values close to the first intensity; and

the second input-output mapping asymptotically approaches the respective maximum output as the device detects intensity values close to the second intensity.

66. The method of any of claims 61-65, wherein:

the first input-output mapping maps a first range of intensity values to a respective range of output; and

the second input-output mapping maps a second range of intensity values, different from the first range of intensity values, to the respective range of output.

67. The method of any of claims 61-66, wherein:

the first input-output mapping has a first portion that corresponds to a range of intensity values below a transition intensity value and a second portion that corresponds to a range of intensity values above the transition intensity value;

the second input-output mapping has a first portion that corresponds to a range of intensity values below the transition intensity value and a second portion that corresponds to a range of intensity values above the transition intensity value;

the first portion of the first input-output mapping is the same as the first portion of the second input-output mapping; and

the second portion of the first input-output mapping is different from the second portion of the second input-output mapping.

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68. The method of claim 67, wherein adjusting the output of the device includes:

in accordance with a determination that a maximum intensity of the contact is below the transition intensity value, generating a same output in accordance with the maximum intensity of the contact without regard to whether the respective location has the first dynamic range or the second dynamic range; and

in accordance with a determination that a maximum intensity of the contact is above the transition intensity value, generating different outputs in accordance with:

the maximum intensity of the contact and,

whether the respective location has the first dynamic range or the second dynamic range.

69. The method of any of claims 61-68, wherein:

the sensors to detect intensity of contacts with the touch-sensitive surface include a plurality of intensity sensors placed around a perimeter of the touch-sensitive surface; and

locations near the perimeter of the touch-sensitive surface have a lower dynamic range than locations near a center of the touch-sensitive surface.

70. The method of any of claims 61-69, including:

while adjusting output of the device in accordance with the first input-output mapping, detecting movement of the contact from a first location on the touch-sensitive surface with the first dynamic range to a second location on the touch-sensitive surface with the second dynamic range; and

in response to detecting the movement of the contact from the first location to the second location, continuing to use the first input-output mapping to adjust the output of the device while the contact is at the second location.

71. The method of any of claims 61-69, including:

while adjusting output of the device in accordance with the first input-output mapping, detecting movement of the contact from a first location on the touch-sensitive surface with the first dynamic range to a second location on the touch-sensitive surface with the second dynamic range; and

in response to detecting the movement of the contact from the first location to the second location, using the second input-output mapping to adjust the output of the device while the contact is at the second location.

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