



(51) International Patent Classification:

G06F 3/033 (2013.01) G06F 3/0481 (2013.01)
G06F 3/041 (2006.01) G06F 3/0488 (2013.01)
G06F 3/048 (2013.01)

(21) International Application Number:

PCT/IB2017/052975

(22) International Filing Date:

19 May 2017 (19.05.2017)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

62/338,607 19 May 2016 (19.05.2016) US

(71) Applicant: ONSHAPE INC. [US/US]; One Alewife Center Suite 130, Cambridge, Massachusetts 02140 (US).

(72) Inventors: MORTON, Michael; 40 Isaac Perkins Road, Lyme, New Hampshire 03768 (US). MORRIS, Andrew John; 28 Lonsdale, Linton Cambridgeshire CB21 4LT (GB). VANGAPALLI, Rammohan; 722 Maple Leaf Loop, Winter Springs, Florida 32708 (US).

(74) Agent: CLOCKTOWER LAW et al.; 537 Massachusetts Ave., Suite 301, Acton, Massachusetts 01720 (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, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, 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, SA, 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.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

(54) Title: TOUCHSCREEN PRECISE POINTING GESTURE

(57) Abstract: The precise touchscreen control allows a user to rapidly choose a point on a touchscreen, confirm that they've touched the point they intended, then perform a pan gesture to a new location, all without their fingertip obscuring any fine details on the screen.

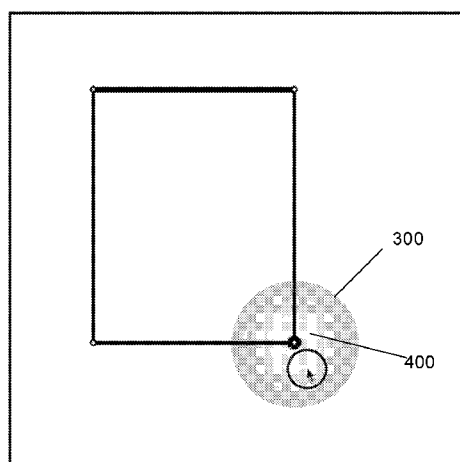


FIG. 4

Declarations under Rule 4.17:

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

Published:

- *with international search report (Art. 21(3))*

Touchscreen Precise Pointing Gesture

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This utility patent application claims priority from U.S. provisional patent application serial number 62/338,607, filed 05-19-2016, titled "Touchscreen Precise Pointing Gesture" naming inventors Michael Morton, Andrew John Morris, and Rammohan Vangapalli.

COPYRIGHT NOTICE

[0002] A portion of the disclosure of this patent document contains material that is subject to copyright protection. The copyright owner has no objection to the facsimile reproduction by anyone of the patent document or the patent disclosure, as it appears in the Patent and Trademark Office patent file or records, but otherwise reserves all copyright rights whatsoever. Copyright 2017 Onshape Inc.

BACKGROUND

[0003] Field of Technology

[0004] This disclosure relates to graphical user interfaces in computer software, and more specifically to any piece of software that requires touch gestures specifying precise points on a device's screen.

[0005] Background

[0006] In many user interactions with a touch screen, precision doesn't matter. Either the user is aiming for a hard-to-miss target (such as a button) or is touching the screen only to scroll in one or both dimensions (in this case, the touch location doesn't matter — only how much they move after they touch).

[0007] In certain other applications, however, the user is trying to start their finger at, or move it to, a precise point. This is inherently difficult, since humans have opaque fingers, and users can't see the portion of the screen under their fingertip(s).

[0008] Prior attempts to address this problem include:

- Magnifiers show a copy of what's directly under the fingertip, near the finger but not under it. The copy need not be magnified, so this is a misnomer in some cases. The display of the copy clarifies what is under the finger, but blocks other parts of the display in the region where the copy is shown.
- Software pointers display a pointer on the screen, with the blunt end of the pointer "anchored" to the user's fingertip. This allows precise selection, but encounters problems near edges of a touchscreen where the pointer length and/or angle may need to alter to allow selection, and also block or obfuscate display under the visible path of the pointer.
- Hardware styluses use a commercial or other stylus with a fine point, minimizing blockage by being smaller than a finger but requiring the stylus.

Description of Prior Art

- [0009] U.S. Pat. App. Pub. No. 2011/0239153 "POINTER TOOL WITH TOUCH-ENABLED PRECISE PLACEMENT" (Cater et al., 2011-09-29) discloses, in the Abstract, "A pointer tool in a touch-screen display is disclosed. The method includes activating a pointer tool in a touch screen display in response to contact with an area of the touch screen and persisting the displaying of the pointer tool in the touch screen display after the contact with the touch screen is removed. Once editing data is received, the pointer tool is removed from the touch screen display."
- [0010] TapTap and MagStick: Improving One-Handed Target Acquisition on Small Touch-screens (Roudaut, Huot, and Lecolinet, AVI'08, the 9th International Working Conference on Advanced Visual Interfaces (2008) 146-153) discloses, in the Abstract, "We present the design and evaluation of TapTap and MagStick, two thumb interaction techniques for target acquisition on mobile devices with small touch-screens. These two techniques address all the issues raised by the selection of targets with the thumb on small tactile screens: screen accessibility, visual occlusion and accuracy. A controlled experiment shows that TapTap and MagStick allow the selection of targets in all areas of the screen in a fast and accurate way. They were found to be faster than four previous techniques except Direct Touch which, although faster, is too error prone. They also provided the best error rate of all tested techniques. Finally the paper also provides a comprehensive study of various techniques for thumb based touch-screen target selection."
- [0011] None of the above provide a touchscreen control to avoid obscuring under a finger touch and including confirmation of an initial selection, dynamic establishment of an offset, and precise positioning while keeping the established offset fixed. What is needed, therefore, is a control that overcomes the above-mentioned limitations and that includes the features enumerated above.

BRIEF SUMMARY

[0012] The solution is a touch screen selection and movement control to select based on initial touch but then establish an offset before any movement, allowing visibility of any movement destination as well as cancelation without movement if the initial selection is incorrect. These features are enabled through:

1. A hotspot selection or activation point where a user touches a screen. This hotspot may be signified by a shape or region display, such as a cross, or visible object selection, such as highlighting an on-screen object at the selection point.
2. A border region, for example a circle, creating a border space around the hotspot. The border region may also have different sizes in different directions, such as with an oval or starfish shape.
3. Any finger movement within the border region has no effect on the hotspot selection point. This allows finger movement to verify (visibly confirm) the selection is correct without actual movement of the selection.
4. Upon finger drag to an edge point (exit point) of the border region, an offset vector (distance and direction) is established between that exit point and the hotspot, and any continued finger movement moves the selection (or selection point) relative to the finger movement while maintaining the same offset. This allows movement of the selection visually unimpeded by the controlling finger.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] In the drawings, closely related figures and items have the same number but different alphabetic suffixes. Processes, states, statuses, and databases are named for their respective functions.

[0014] **Fig. 1** is a flowchart of the precise positioning process.

[0015] **FIG. 2** shows an example touchscreen device interface.

[0016] **FIG. 3** shows the example touchscreen device interface as a user touch event begins.

[0017] **FIG. 4** shows the example touchscreen device interface after the user touch event begins during establishment of an offset selection with finger movement away from an initial touch point.

[0018] **FIG. 5** shows a continuation of Fig. 3 with finger movement back towards the initial touch point.

[0019] **FIG. 6** shows the example touchscreen device interface after the user ends the touch event before establishing an offset selection.

[0020] **FIG. 7** shows the example touchscreen device interface during the user touch event with an offset selection established.

[0021] **FIG. 8** shows the example touchscreen device after completion of the user touch event which used offset selection for dragging.

DETAILED DESCRIPTION, INCLUDING THE PREFERRED EMBODIMENT

Terminology

[0022] The terminology and definitions of the prior art are not necessarily consistent with the terminology and definitions of the current invention. Where there is a conflict, the following definitions apply.

[0023] Activation point – the location on a touchscreen where a touch event begins. The activation point is used for selection control during precise positioning.

[0024] Border region – a shape around an activation point during establishment of precise positioning control event. Finger-slide movement within the border region will not change or move any item selected at an activation point until an exit point is established. After an exit point is established, the border region has no further effect during that precise positioning event.

[0025] Exit point – the location on the edge of a border region where a finger slides while activating a precise positioning control. The exit point to activation point vector establishes an offset of fixed distance and relative position for controlled movement of anything selected at the activation point during precise positioning.

[0026] Interface – graphical output of a computer system or individual program on a physical display, having elements for user selection or interaction through input devices, which may include the physical display if a touchscreen display.

[0027] Movable Element – any visually displayed entity or portion within an interface capable of being selected and moved by a user independently from other objects displayed within the interface.

[0028] Offset Vector – a direction and distance between a location of touch and a selected movable element being moved during precise positioning.

[0029] Precise positioning control event – a touch-control event for moving a selection on a touchscreen display interface which may be obscured by normal touch-control. The precise positioning control event begins after an initial touch of a touch event at an activation point and an additional indication that precise positioning control is desired (which may occur simultaneously or separately), and ends when the touch event ends.

[0030] Touch event – system detected contact on a touchscreen, usually by a finger or touch screen stylus. A touch event includes an initial location, a current location, and may include detected pressure. The touch event ends when the contact with the touchscreen ends.

[0031] Touchscreen display – an input/output device built into or otherwise connected to a computer device, having an electronic visual display screen capable of displaying visual video, image, or text, and detecting contact and location of one or more fingers or contact devices such as a stylus touching the screen.

Operation

[0032] In the following detailed description, reference is made to the accompanying drawings which form a part hereof, and in which are shown, by way of illustration, specific embodiments which may be practiced. It is to be understood that other embodiments may be used, and structural changes may be made without departing from the scope of the present invention.

[0033] Users interacting with a software application using a touchscreen sometimes want to use their fingertip to point to a precise position for selection or control on the screen. This is frequently done with mobile computing devices, such as a phones or tablets, but can be with any computer device using a touch screen display. Precise positioning can be desirable in many different situations, but is frequently needed when selecting objects or positions smaller than the size of a finger. In such scenarios, the finger used for selection or control obscures view of the desired target, creating a need for more precise position selection.

[0034] The user interacts with the touchscreen to indicate or activate precise positioning. Some example methods which may be used for such indication include, but are not limited to:

- * the user touches a spot on the screen, such as a dedicated button, before or after touching to establish an activation point
- * the user touches the screen to establish an activation point and then makes a specific gesture, such as a pre-configured multi-touch or specific finger movement pattern
- * the user touches the screen to establish an activation point and then holds the touch in a fixed position for a pre-configured duration
- * the user touches the screen to establish an activation point and then uses a non-touch command, such as shaking or movement of the touch screen device, or a voice command
- * automatically enabled for any touch control (preferably application-specific)

These activation controls may be configured at a system level (such as a system setting in the operating system running on the device) or at an application level (within an application running on the operating system running on the device), and may be pre-configured and fixed or dynamically configurable by any user or restricted to configuration by an authorized user. Each indication method is also associated with an initial user touch to establish an activation point.

[0035] During operation of precise positioning, a computer processor of the device operates software code to identify the activation point, select any object or element capable of movement at the activation point, track finger movement touching the screen, and calculate movement and offsets from the activation point along with any graphical display updates. The software may be part of a running application or part of an operating system stored and run on the device.

[0036] Referring to **Figs. 1** and **2**, a user makes an initial touch **100** at the specific point on the screen. As shown in the figure, the touch is at the corner of a box **210**. Pointer arrow **200** represents the center point of a user's finger. With receipt of indication **105** from the user that precise positioning is desired, the position of the initial touch is the activation point for precise positioning.

[0037] Referring also to **Fig. 3**, with precise positioning activated **110** the display changes to display **115** border region **300** visually indicating that the user should establish an offset from the activation point. Pointer arrow **200** represents the center point of the user's finger, and circle **310** represents the entire touch area of finger, effectively blocking view of anything within circle **310**. Border region **300** includes a circular ring with a gradient diminishing towards the activation point. Alternative border region indications are possible, and may include, but are not limited to:

- * displaying an arrow pointing to the activation point from the current finger position
- * displaying a crosshair or similar shape centered on the activation point
- * displaying a shape such as a hollow circle, centered on the activation point
- * displaying any other empty shape, or an empty shape with a partially transparent center, centered on the activation point.

[0038] After precise positioning is activated, the user moves **120** their finger. Referring to **Figs. 4** and **5**, border region **300** may change **125** to provide visual indication, such as reducing gradient fill **400** in the center when moving toward the edge (**Fig. 4**) and increasing gradient fill **500** in the center when moving towards the activation point (**Fig. 5**). The visual indication may be a configurable display hinting that reaching the edge of the border region will have effect. For example, the border region may fade to transparent as the finger approaches the edge, as a hint that it will disappear entirely when the edge is reached. Alternatively, a visible pointer may display between the fingertip and the original point it touched (equivalent to an offset vector once the edge is reached), with the pointer fading to transparent as the finger gets near the edge, indicating that "mouse arrow" functionality is there even with the pointer is no longer visible. The timing and degree of transparency of the pointer and offset arrow may also be a configurable property. Some users may prefer a visible arrow, while other do not, and others may appreciate the visible arrow during initial use of precise positioning and invisible after a learning period has completed.

[0039] Referring also to **Fig. 6**, lifting **130** the finger ends **135** precise positioning, and display of the border region ceases. This may be particularly useful if the desired target was not selected by the activation point, which may be revealed during finger

movement within the border region. Any border region shape with one or more elongated lobes (e.g., a starfish) particularly serves this purpose. For example, a shape such as an elongated oval allows the user to move quickly to a nearby edge of the oval to lock in selection, but also gives room to move into a lobe of the oval without locking in to first confirm selection if desired. To restart precision pointing after canceling, the user may initiate again as described above. Alternatively, there may be a “selection correction delay” of a pre-configured interval (for example, 5 seconds) during which any next touch is treated automatically as activating precision pointing. This allows rapid re-selection with precise positioning without having to re-signal activation.

[0040] Referring also to **Fig. 7**, if the finger reaches **140** edge **700** of the border region, an exit point is established at the point where the edge is reached. At this point, an offset vector of distance and angle is established **145** between the exit point and activation point. Different graphical indication options may be used **150**, such as, but not limited to, clearing the gradient fill in the border region, changing an edge color of the border region, displaying an arrow equivalent to the offset vector, initially pointing from the exit point to the activation point, or any combination of graphical indications. The graphical indication signifies that precise positioning has switched into movement mode. During movement mode, any selection made at the activation mode is moved **155** by an amount equivalent to finger slide motion **160**, remaining the offset vector away from the current finger touch position. This allows precise positioning unobscured by the finger controlling the touch. During movement mode, the graphical indication may continued to display (and move with finger slide motion) to indicate precise positioning is still active, or alternatively alter such as fading to partial transparency or fading completely to avoid any visual obstruction. In applications such as text movement, or other positioning movement between objects (such as a icon within a grid layout of icons), selection may “snap” to a closest position to the end of the offset vector rather than continuously moving with the finger movement.

[0041] Referring also to **Fig. 8**, when the user lifts **130** the finger during movement mode, precise positioning ends with the selection at its moved position. In the illustrated

example, the corner of box **210** has been moved to the left, with finger control for movement offset to the right.

Other Embodiments

[0042] The invention may be written in any of several widely available programming languages, and may be coded as a subroutine, module, subsystem, or object depending on the language and environment. In a server-client architecture it may be implemented on the server or client or any combination.

[0043] In an alternate embodiment, the display within the shape may be magnified for more precise selection. The magnification may be by a fixed amount, vary with the speed of finger movement, or be controlled by another function such as a concurrent multi-touch gesture. Magnification may be used as a “lock-in” selection mode, and toggled on/off, where while magnified the selection point may be moved without lifting the touch to restart precise positioning.

[0044] In another alternative embodiment, precise positioning may operate as part of any multitouch gesture, with each finger operating independently, and some or all of fingers able to switch to precision positioning mode.

[0045] In another alternative embodiment, once the finger reaches the edge of the border region, a slight amount of movement is allowed before locking in the selection and offset arrow. This hysteresis allows the user to select the original point if the whole point of the operation was selection. The hysteresis amount may be indicated by the thickness of the ring.

[0046] In another alternative embodiment, the border region is used only to confirm the selection was correct, and not to move the selection. In such case, lifting a finger from touching the device while outside of the shape confirms selection, while lifting the finger from inside the shape (independent of whether the shape border has been crossed) cancels selection.

[0047] In another alternative embodiment, selection confirmation requires a multi-finger action, such as tapping a second finger. This allows adjusting the activation point without canceling and restarting precise positioning. After confirmation, finger movement to the edge of the border region establishes the offset pointer for dragging.

[0048] In another embodiment, the border region may include markings to indicate selection of an angle. For example, there may be tickmarks every 90° (or other configured angle) inside a ring. As your finger moves, the crosshairs rotate, presenting as a free-rotating ring.

[0049] It is to be understood that the above description is intended to be illustrative, and not restrictive. Many other embodiments will be apparent to those of skill in the art upon reviewing the above description. The scope of the invention should, therefore, be determined with reference to the appended claims, along with the full scope of equivalents to which such claims are entitled.

CLAIMS

What is claimed is:

Claim 1. A method of precise positioning comprising:

- displaying an interface with selectable and movable elements on a touchscreen display of a computer device;

- detecting an initial touch of a finger or stylus at a location within the interface on the touchscreen display;

- tracking an activation point at the location of the initial touch;

- selecting a movable element within the interface at the activation point;

- receiving user indication for precise positioning;

- displaying a border region around the activation point;

- identifying an exit point on an edge of the border region when the finger or stylus slides through and out of the border region;

- determining an offset vector of distance and direction from the exit point to the activation point;

- moving the selected movable element with further slide movement of the finger or stylus, keeping the selected element positioned the offset vector away from a current touch position of the finger or stylus; and

- ending precise position when the finger or stylus is lifted from the touchscreen.

Claim 2. The method of claim 1, wherein receiving user indication comprises a user touch of a dedicated spot on the touchscreen display before or after the initial touch.

Claim 3. The method of claim 1, wherein receiving user indication comprises a multi-finger touch or specific finger gesture movement after the initial touch.

Claim 4. The method of claim 1, wherein receiving user indication comprises the user holding the initial touch without movement for a preconfigured duration.

Claim 5. The method of claim 1, wherein receiving user indication comprises a non-touch command of moving the touchscreen display or giving a voice command.

Claim 6. The method of claim 1, wherein receiving user indication is automatically triggered by a specific operating application.

Claim 7. The method of claim 1, wherein displaying the border region further comprises displaying an arrow pointing to the activation point from the current touch position.

Claim 8. The method of claim 1, wherein displaying the border region further comprises displaying a cross-hair centered on the activation point.

Claim 9. The method of claim 1, wherein displaying the border region further comprises displaying an empty shape centered on the activation point.

Claim 10. The method of claim 1, wherein displaying the border region further comprises displaying a shape around the activation point having different sizes in different directions.

Claim 11. The method of claim 1, further comprising displaying visual indication of touch movement within the border regions.

Claim 12. The method of claim 11, wherein visual indication is a gradient fill of the border region such that gradient fill is reduced around the activation point when the current touch position moves towards the edge of the border region, and gradient fill is increased around the activation point when the current touch position moves towards the activation point.

Claim 13. The method of claim 11, wherein visual indication is a fade to transparent of the border region as the current touch point approaches the edge of the border region.

Claim 14. The method of claim 1, further comprising displaying the offset vector between the current touch point and activation point.

Claim 15. The method of claim 1, further comprising lifting the finger or stylus within the border region, detecting a second touch by the finger or stylus within a preconfigured time period of lifting, resetting the activation point at the location of the second touch, and treating the second touch as user indication for precise positioning.

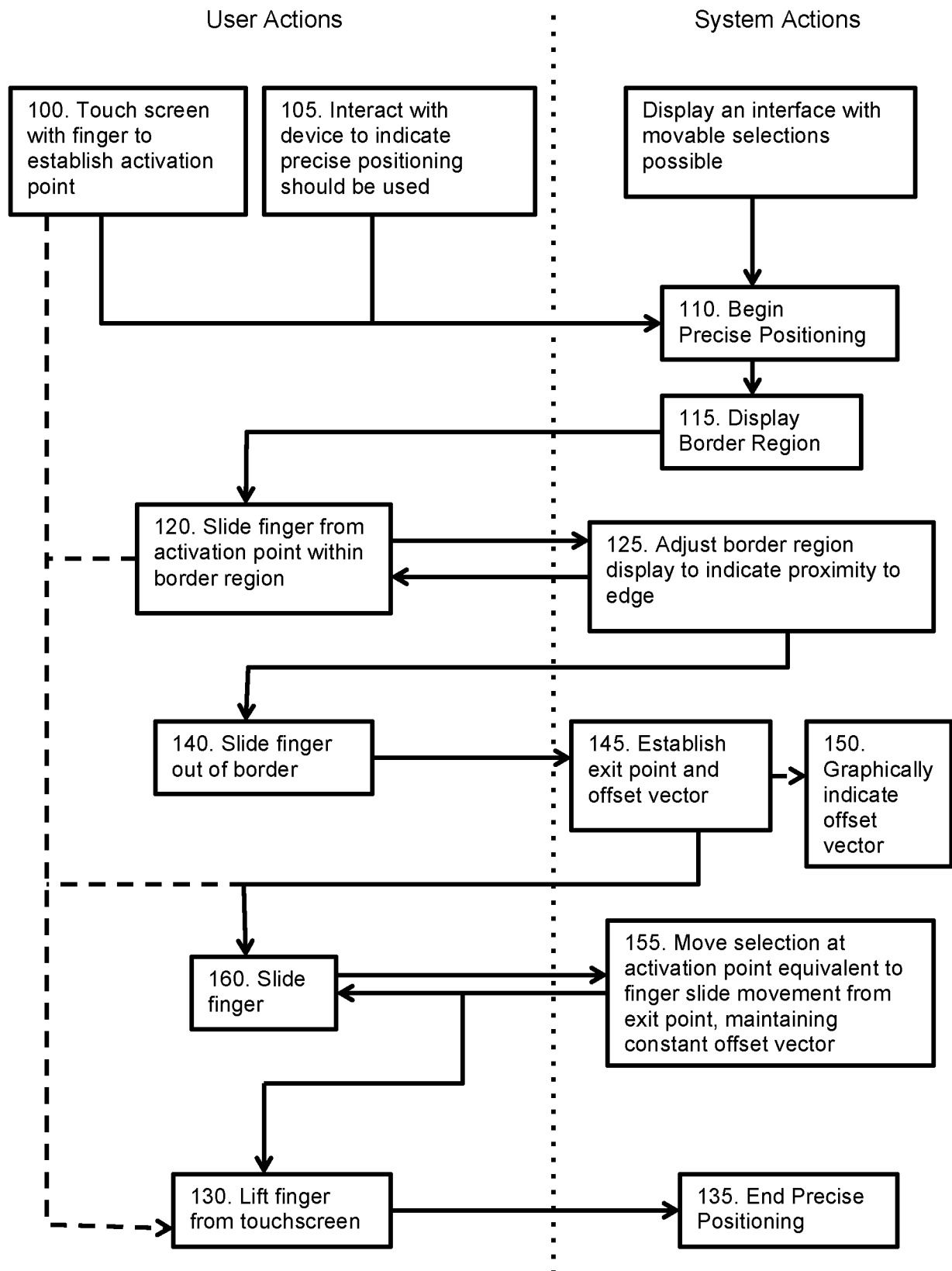


FIG. 1

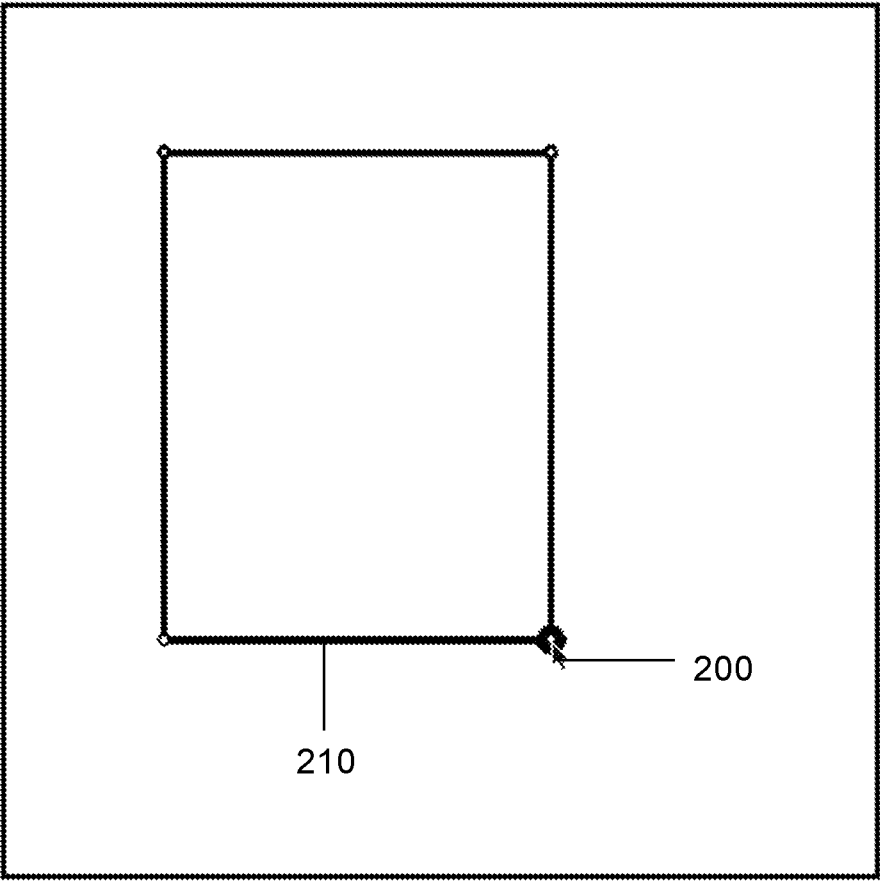


FIG. 2

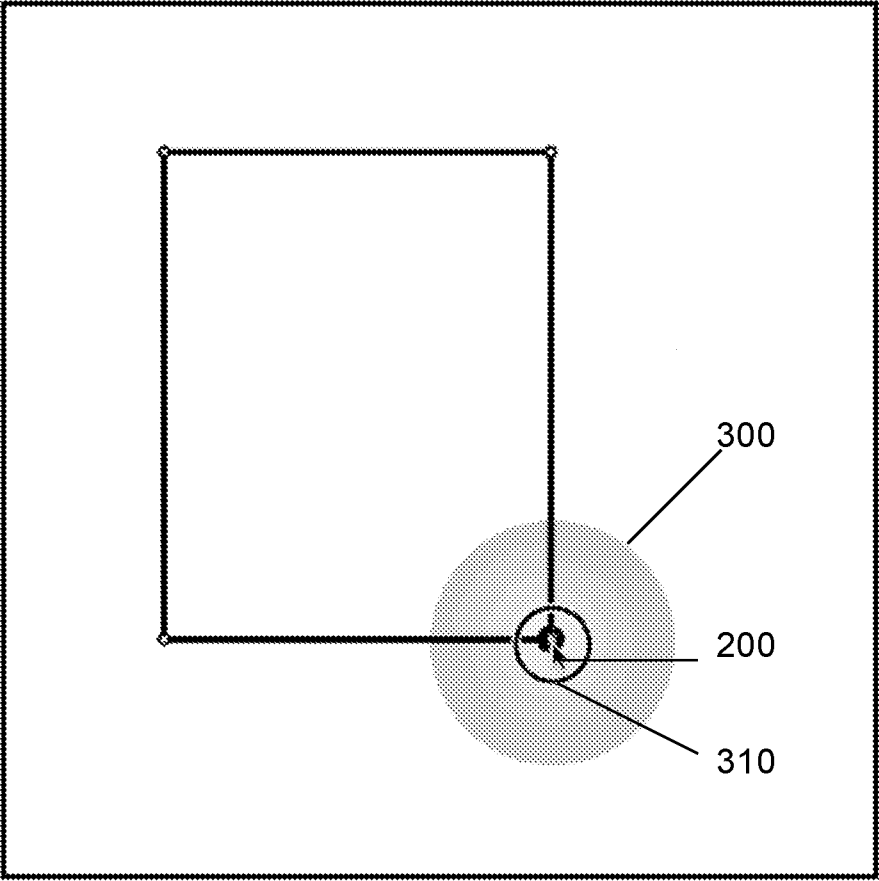


FIG. 3

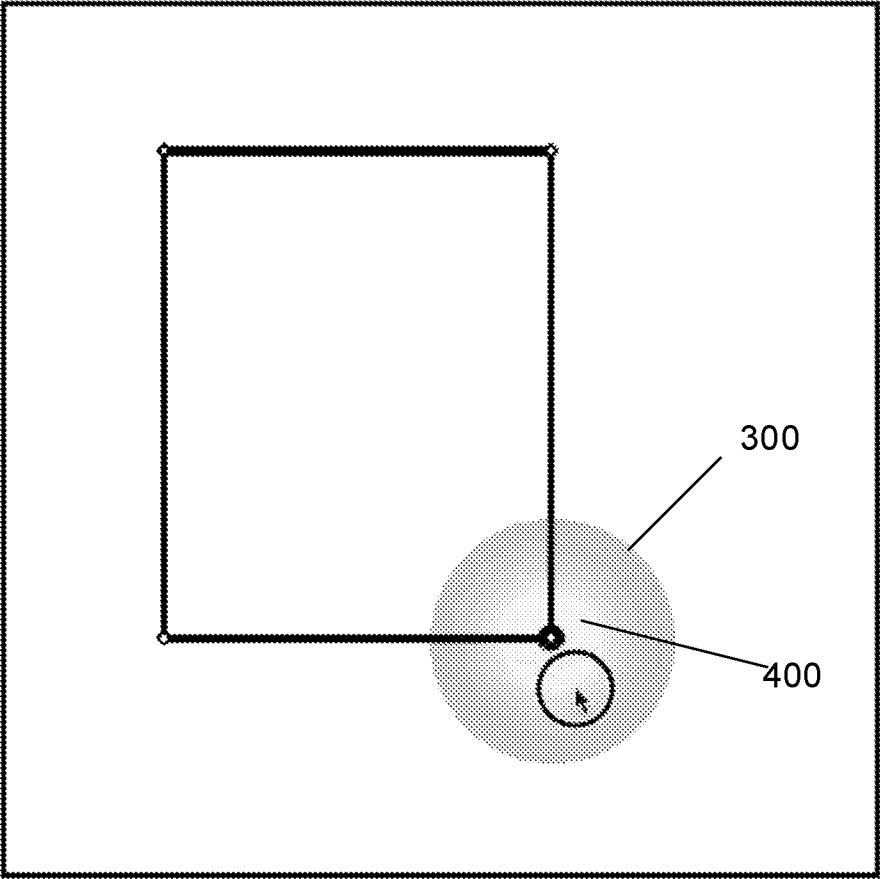


FIG. 4

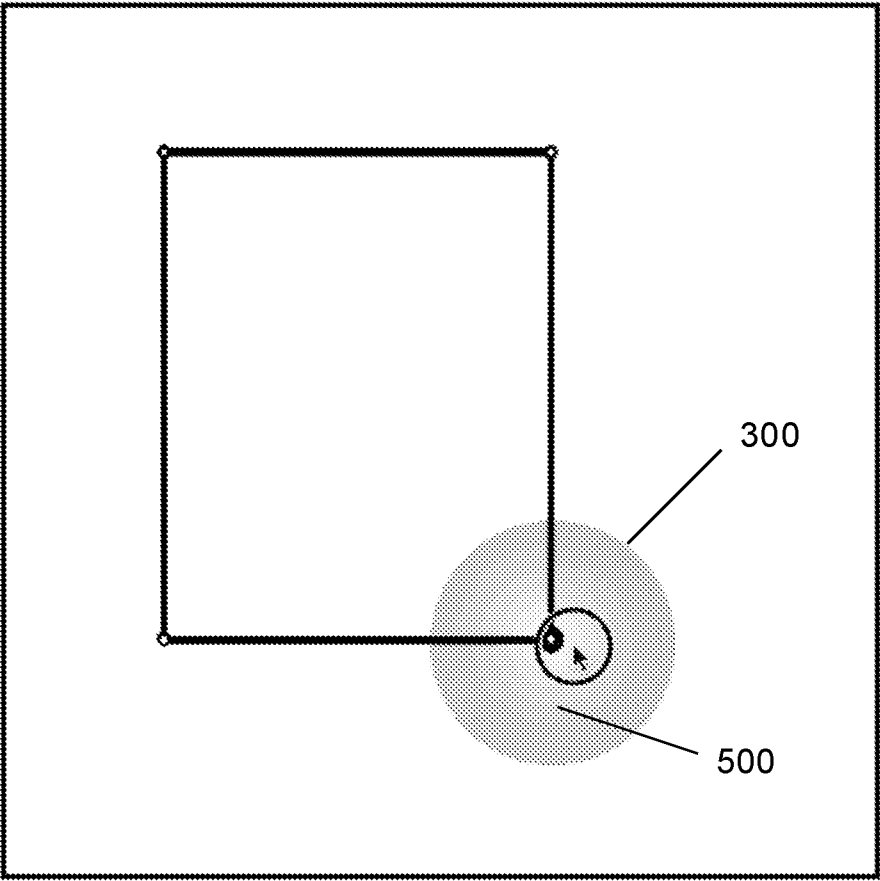


FIG. 5

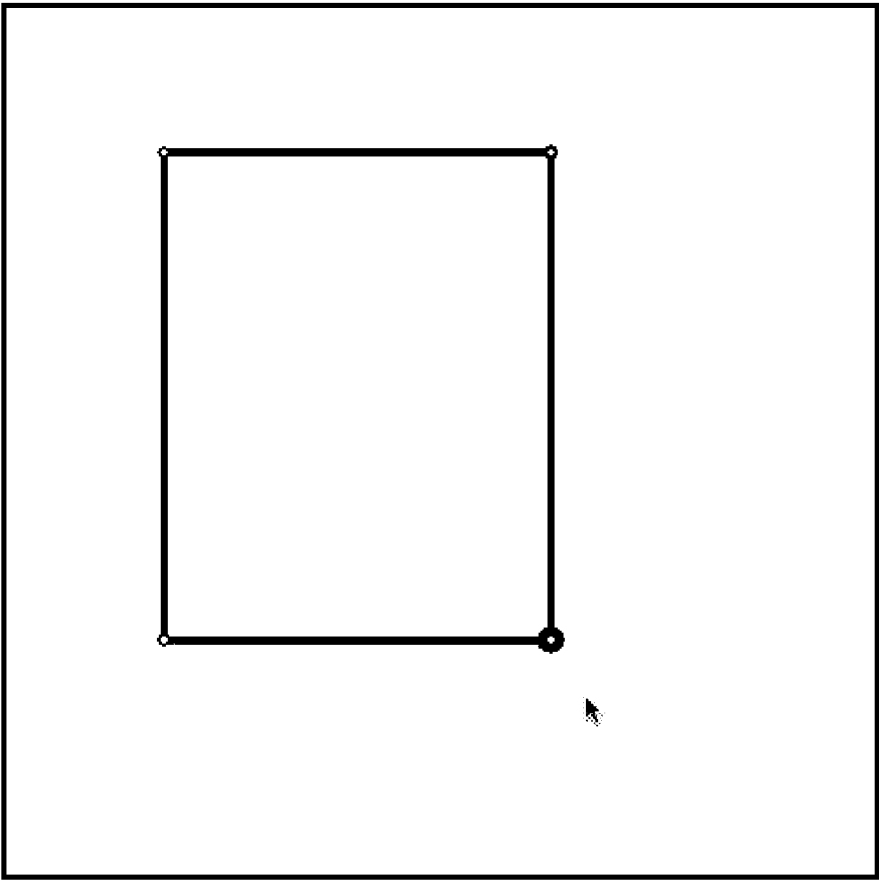


FIG. 6

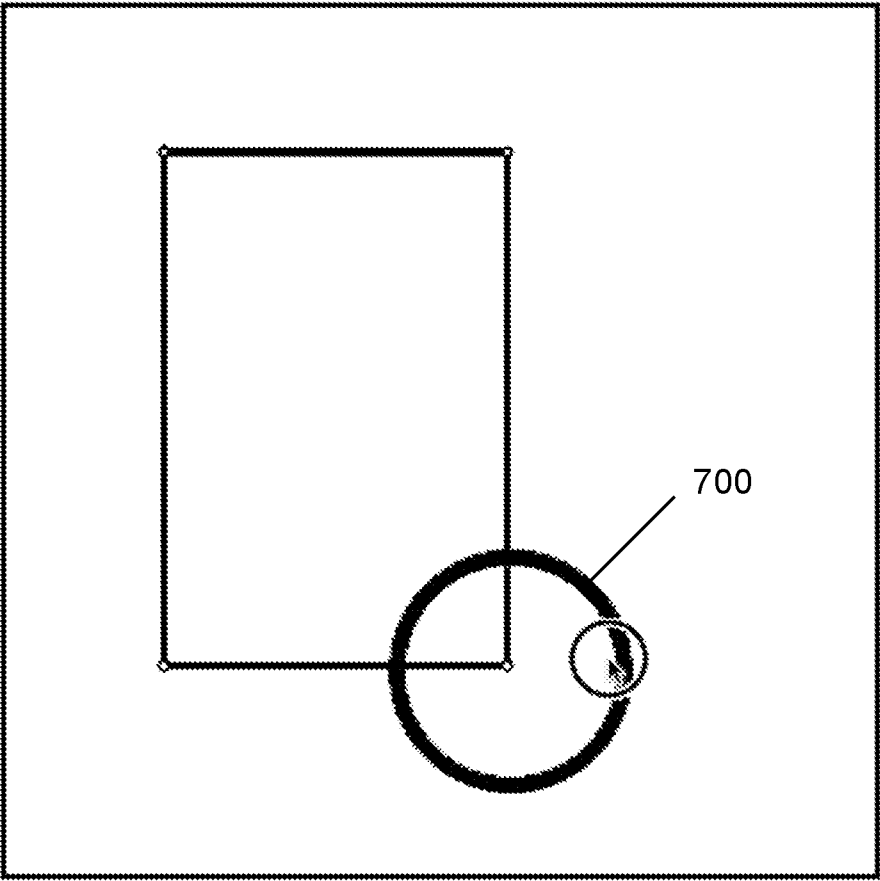


FIG. 7

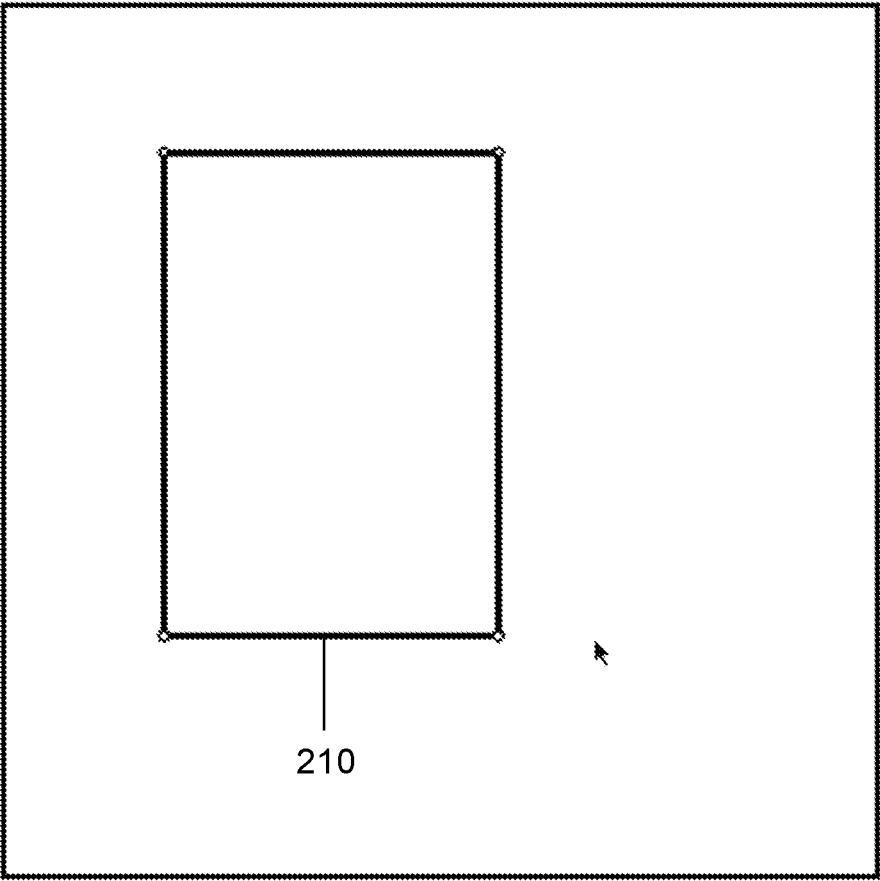


FIG. 8

INTERNATIONAL SEARCH REPORT

International application No.

PCT/IB2017/052975

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - G06F 3/033, 3/041, 3/048, 3/0481, 3/0488 (2017.01)

CPC - G06F 3/033, 3/0416, 3/04812, 3/04883 (2017.02)

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)

See Search History document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

USPC - 345/173, 179; 715/784, 856 (keyword delimited)

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

See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2009/0207144 A1 (BRIDGER) 20 August 2009 (20.08.2009) entire document	1-14
Y	US 2008/0042994 A1 (GILLESPIE et al) 21 October 2008 (21.02.2008) entire document	1-14
---		---
A		15
Y	US 2014/0278419 A1 (MICROSOFT CORPORATION) 18 September 2014 (18.09.2014) entire document	5, 6
Y	US 2010/0328232 A1 (WOOD) 30 December 2010 (30.12.2010) entire document	8
Y	US 2009/0135162 A1 (VAN DE WIJDEVEN et al) 28 May 2009 (28.05.2009) entire document	10
Y	US 2013/0335333 A1 (KUKULSKI et al) 19 December 2013 (19.12.2013) entire document	12, 13
A	US 6,473,069 B1 (GERPHEIDE) 29 October 2002 (29.10.2002) entire document	15
A	WO 2014/084876 A2 (MICROSOFT CORPORATION) 05 June 2014 (05.06.2014) entire document	15

☐ 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

26 July 2017

Date of mailing of the international search report

11 AUG 2017

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US, Commissioner for Patents

P.O. Box 1450, Alexandria, VA 22313-1450

Facsimile No. 571-273-8300

Authorized officer

Blaine R. Copenheaver

PCT Helpdesk: 571-272-4300

PCT OSP: 571-272-7774