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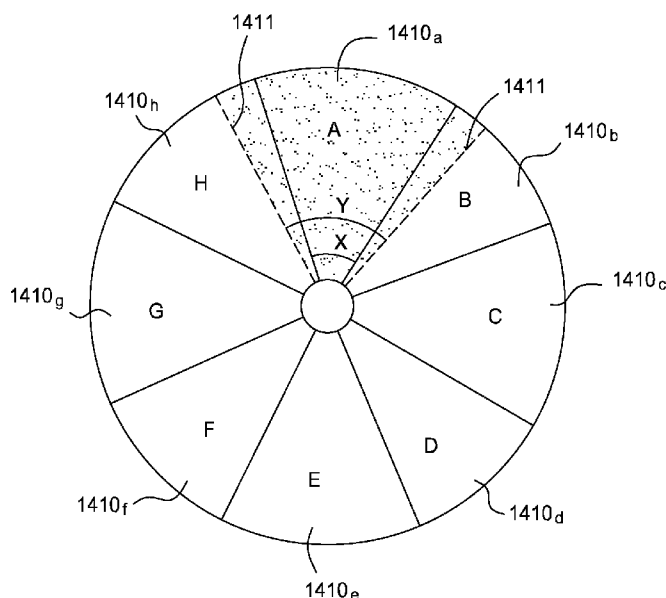
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(54) Title: RADIAL MENUS WITH VARIABLE SELECTABLE ITEM AREAS



(57) Abstract: A method and apparatus for facilitating selection of items from a radial menu. Radial menu items may be differentiated from one another based on a desired difficulty of selection from the radial menu. Where it is desirable to make a radial menu item easy to select, the radial menu item may be placed in a relatively larger pie slice of the radial menu. Conversely, where it is desirable to make a radial menu item difficult to select, the radial menu item may be placed in a relatively smaller pie slice of the radial menu.

FIG. 14



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## **RADIAL MENUS WITH VARIABLE SELECTABLE ITEM AREAS**

### Field of the Invention

5 The present invention is generally related to graphical user interfaces (GUIs), and more specifically to selecting items from a radial menu.

### Background of the Invention

10 Most modern computers include applications that allow a user to interact with the application while performing operations associated with the application. For example, an application may be configured to receive commands from the user to display data, modify data, initiate a particular task, and the like. In the past, user interaction with applications was facilitated by a command line interface. The command line interface allowed users to type  
15 predefined commands to interact with an application. However, command line interfaces require users to memorize large lists of commands to communicate with each application.

More recently, user interaction with applications has involved the use of graphical user interfaces, or GUIs. For example, most applications today are configured to display a  
20 window including a menu bar on a display screen. The menu bar may include one or more pull down menus including lists of functions and commands that may be used to interact with the application.

### Disclosure of the Invention

25 The present invention is generally related to graphical user interfaces (GUIs), and more specifically to selecting items from a radial menu.

30 One embodiment of the invention provides a computer implemented method for displaying a radial menu, comprising configuring one or more processors to perform an operation. The operation generally comprises displaying, on a screen of an output device, a radial menu comprising a plurality of pie slices, each pie slice defining a selection zone for a respective

radial menu item, wherein a first pie slice of the plurality of pie slices has a first predefined size. The operation further comprises receiving a first gesture that moves a screen pointer over the first pie slice on the screen, thereby activating the first pie slice of the radial menu. In response to the activation of the first pie slice, the operation further comprises executing a menu manager on one or more of the processors to change a size of the first pie slice from the first predefined size to a second predefined size.

Another embodiment of the invention provides a computer readable storage medium comprising a program product which, when executed, is configured to perform an operation for displaying a radial menu. The operation generally comprises displaying, on a screen of an output device, a radial menu comprising a plurality of pie slices, each pie slice defining a selection zone for a respective radial menu item, wherein a first pie slice of the plurality of pie slices has a first predefined size. The operation further comprises receiving a first gesture that moves a screen pointer over the first pie slice on the screen, thereby activating the first pie slice of the radial menu. In response to the activation of the first pie slice, the operation further comprises executing a menu manager on one or more of the processors to change a size of the first pie slice from the first predefined size to a second predefined size.

Yet another embodiment of the invention provides a system generally comprising a memory comprising a program and a processor. The processor, when executing the program, is configured to: display, on a screen of an output device, a radial menu comprising a plurality of pie slices, each pie slice defining a selection zone for a respective radial menu item, wherein a first pie slice of the plurality of pie slices has a first predefined size. The processor is further configured to receive a first gesture that moves a screen pointer over the first pie slice on the screen, thereby activating the first pie slice of the radial menu. In response to the activation of the first pie slice, the processor is configured to change a size of the first pie slice from the first predefined size to a second predefined size.

A further embodiment of the invention provides a computer implemented method for displaying a radial menu, comprising configuring one or more processors to perform an operation. The operation generally comprises receiving a predefined screen pointer event for displaying a radial menu on a screen of an output device, and in response to receiving the

predefined screen pointer event determining a plurality of radial menu items to be displayed in the radial menu, wherein each radial menu item has an associated weight value. The method further comprises displaying, on the screen, the plurality of radial menu items in respective pie slices of the radial menu, wherein a size of each of the pie slices is determined  
5 based on the weight value of a respective radial menu item.

#### Brief Description of the Drawings

So that the manner in which the above recited features and advantages of the present  
10 invention are attained and can be understood in detail, a more particular description of the invention, briefly summarized above, may be had by reference to the embodiments thereof which are illustrated in the appended drawings.

It is to be noted, however, that the appended drawings illustrate only typical embodiments of  
15 this invention and are therefore not to be considered limiting of its scope, for the invention may admit to other equally effective embodiments.

Figure 1 illustrates a drop-down menu according to the prior art.

20 Figure 2 illustrates an exemplary system according to an embodiment of the invention.

Figure 3 illustrates an exemplary radial menu according to an embodiment of the invention.

Figures 4A-4C illustrate further exemplary radial menus according to embodiments of the  
25 invention.

Figure 5 illustrates an exemplary screen pointer event for displaying a radial menu,  
according to an embodiment of the invention.

30 Figure 6 illustrates an exemplary stroke according to an embodiment of the invention.

Figures 7A-7C illustrate exemplary strokes for selecting a radial menu item, according to an embodiment of the invention.

5 Figure 7D illustrates an overloaded radial menu according to an embodiment of the invention.

Figure 7E illustrates an exemplary graphical user interface for defining gestures, according to an embodiment of the invention.

10 Figure 8 illustrates an exemplary selection zone according to an embodiment of the invention.

Figure 9 illustrates another exemplary selection zone according to an embodiment of the invention.

15 Figure 10 is a flow diagram of exemplary operations performed by a menu manager, according to an embodiment of the invention.

20 Figure 11 illustrates a radial menu having variable selectable item areas, according to an embodiment of the invention.

Figure 12 is a flow diagram of exemplary operations performed to place radial menu items in a radial menu having variable selectable item areas, according to an embodiment of the invention.

25 Figure 13 illustrates another radial menu having variable selectable item areas, according to an embodiment of the invention.

30 Figures 14-16 illustrate a radial menu having overlapping selectable item areas, according to an embodiment of the invention.

Detailed Description of the Preferred Embodiments

The present invention is generally related to graphical user interfaces (GUIs), and more specifically to selecting items from a radial menu. Radial menu items may be differentiated from one another based on a desired difficulty of selection from the radial menu. Where it is desirable to make a radial menu item easy to select, the radial menu item may be placed in a relatively larger pie slice of the radial menu. Conversely, where it is desirable to make a radial menu item difficult to select, the radial menu item may be placed in a relatively smaller pie slice of the radial menu.

In the following, reference is made to embodiments of the invention. However, it should be understood that the invention is not limited to specific described embodiments. Instead, any combination of the following features and elements, whether related to different embodiments or not, is contemplated to implement and practice the invention. Furthermore, in various embodiments the invention provides numerous advantages over the prior art. However, although embodiments of the invention may achieve advantages over other possible solutions and/or over the prior art, whether or not a particular advantage is achieved by a given embodiment is not limiting of the invention. Thus, the following aspects, features, embodiments and advantages are merely illustrative and are not considered elements or limitations of the appended claims except where explicitly recited in a claim(s). Likewise, reference to “the invention” shall not be construed as a generalization of any inventive subject matter disclosed herein and shall not be considered to be an element or limitation of the appended claims except where explicitly recited in a claim(s).

One embodiment of the invention is implemented as a program product for use with a computer system. The program(s) of the program product defines functions of the embodiments (including the methods described herein) and can be contained on a variety of computer-readable storage media. Illustrative computer-readable storage media include, but are not limited to: (i) non-writable storage media (e.g., read-only memory devices within a computer such as CD-ROM disks readable by a CD-ROM drive) on which information is permanently stored; (ii) writable storage media (e.g., floppy disks within a diskette drive or hard-disk drive) on which alterable information is stored. Such computer-readable storage media, when carrying computer-readable instructions that direct the functions of the present invention, are embodiments of the present invention. Other media include communications

media through which information is conveyed to a computer, such as through a computer or telephone network, including wireless communications networks. The latter embodiment specifically includes transmitting information to/from the Internet and other networks. Such communications media, when carrying computer-readable instructions that direct the functions of the present invention, are embodiments of the present invention. Broadly, computer-readable storage media and communications media may be referred to herein as computer-readable media.

In general, the routines executed to implement the embodiments of the invention, may be part of an operating system or a specific application, component, program, module, object, or sequence of instructions. The computer program of the present invention typically is comprised of a multitude of instructions that will be translated by the native computer into a machine-readable format and hence executable instructions. Also, programs are comprised of variables and data structures that either reside locally to the program or are found in memory or on storage devices. In addition, various programs described hereinafter may be identified based upon the application for which they are implemented in a specific embodiment of the invention. However, it should be appreciated that any particular program nomenclature that follows is used merely for convenience, and thus the invention should not be limited to use solely in any specific application identified and/or implied by such nomenclature.

Figure 1 illustrates an exemplary graphical user interface (GUI) 100 according to the prior art. GUI 100 may be displayed on a display screen, such as, for example, a computer monitor to facilitate communication between a user and an application. The GUI 100 may include a menu bar 120 having a plurality of menus including, for example, the File menu, Edit menu, View menu, Tools menu, and Help menu, as illustrated in Figure 1. A particular menu may be selected from the menu bar, for example, by clicking on a desired menu using a mouse. Each of the menus in the menu bar 120 are drop down menus. Therefore, when a particular menu is selected, a list of items in the menu is displayed.

A particular item may be selected from a drop down menu by moving the mouse pointer vertically up and down the list until the mouse pointer is above a desired item. Selecting a



menu item may include performing a second mouse click to select the desired item. For example, a first mouse click on a desired menu may display menu items in a drop down list. A user may then move a mouse pointer vertically up and/or down until the mouse pointer is over a desired menu item. Once the mouse pointer is above the desired menu item, a second  
5 click of the mouse may result in the selection of the menu item.

In some cases, a menu item may be a sub-menu. For example, the Send To item of the File Menu may be a sub-menu. Accordingly, as illustrated in Figure 1, moving the mouse pointer over the Send To item may result is a cascaded sub-menu 122 to be displayed. Each  
10 cascaded sub-menu may have its own cascaded sub menu, which may result in several cascaded sub-menus being displayed before the desired item is selected.

However, menu bars and drop down menus are not efficient at allowing a user to quickly select a desired item. First, selecting a menu item requires at least two mouse clicks as  
15 described above. Second, in drop down menus having a large number of items, the menu items may be closely spaced, which may require the user to scan up and down along the menu several times before a desired item is found. Furthermore, drop down menus with a large number of closely spaced items have an increased probability of erroneous selection of menu items.

The inefficiency of drop down menus may adversely affect users of applications where a fast response time is desired from the user while interacting with the applications. For example, in a gaming application a user's response time in responding to a particular circumstance in the game may be critical to the user's performance in the game. As an example, in a game  
25 where performance is determined by the user's ability to defeat opponents in a fight, the ability of the user to detect and quickly attack opponents may be crucial to performing successfully completing the game.

Embodiments of the invention provide radial menus that allow users to quickly make  
30 selections of menu items using a set of predefined gestures. The predefined gestures may include simple and/or complex gestures. The terms "simple" and "complex" as used herein are not meant to be limiting on the invention. Rather, the terms "simple" and "complex" are

used to illustrate that a wide range of different gestures may be used to facilitate interaction between a user and a radial menu.

In one embodiment, a radial menu may be displayed on a display screen in response to detecting a predefined screen pointer event such as a mouse click. Other screen pointer events may include touching the display screen with a finger or stylus pen, pressing one or more keys on a keyboard, receiving a voice command, and the like. Thereafter, a complex gesture may be made using the screen pointer to select the active radial menu item.

## EXEMPLARY SYSTEM

Figure 2 depicts a block diagram of a system 200 in which embodiments of the invention may be implemented. The system 200 may include a Central Processing Unit (CPU) 211 connected via a bus 220 to a memory 212, storage 216, an input device 217, an output device 218, and a network interface device 219. The input device 217 can be any device to give input to the system 200. For example, a keyboard, keypad, light-pen, touch-screen, track-ball, or speech recognition unit, audio/video player, and the like could be used. The output device 218 can be any device to give output to the user, e.g., any conventional display screen. Although shown separately from the input device 217, the output device 218 and input device 217 could be combined. For example, a display screen with an integrated touch-screen, a display with an integrated keyboard, or a speech recognition unit combined with a text speech converter could be used.

The network interface device 219 may be any entry/exit device configured to allow network communications between the system 200 and one or more other devices 291 via a network 290. For example, the network interface device 119 may be a network adapter or other network interface card (NIC).

Storage 216 is preferably a Direct Access Storage Device (DASD). Although it is shown as a single unit, it could be a combination of fixed and/or removable storage devices, such as fixed disc drives, floppy disc drives, tape drives, removable memory cards, or optical

storage. The memory 212 and storage 216 could be part of one virtual address space spanning multiple primary and secondary storage devices.

5 The memory 212 is preferably a random access memory sufficiently large to hold the necessary programming and data structures of the invention. While memory 212 is shown as a single entity, it should be understood that memory 212 may in fact comprise a plurality of modules, and that memory 212 may exist at multiple levels, from high speed registers and caches to lower speed but larger DRAM chips.

10 Illustratively, the memory 212 contains an operating system 213. Illustrative operating systems, which may be used to advantage, include Linux (Linux is a trademark of Linus Torvalds in the US, other countries, or both) and Microsoft's Windows®. More generally, any operating system supporting the functions disclosed herein may be used.

15 Memory 212 may also include one or more applications 214. The applications 214 may be software products comprising a plurality of instructions that are resident at various times in memory and storage devices in the computer system 200. When read and executed by one or more CPU 211, the applications 214 may cause the computer system 200 to perform the steps necessary to execute steps or elements embodying the various aspects of the invention.

20 In one embodiment, the applications 214 may include a menu manager program 215, which may be configured to display a radial menu on the output device 218, and detect selection of one or more radial menu items, as is discussed in greater detail below. In some embodiments the application program 214 and menu manager 215 may reside on a  
25 networked computer device 291 and may be configured to manage radial menus on the output device 118 of computer system 200. The applications 214 may also include user preferences 221. The user preferences 221 may determine one or more characteristics of radial menus, for example, the displaying of radial menus, making selections from radial menus, and the like, as will be discussed in greater detail below.

## EXEMPLARY RADIAL MENUS

Figure 3 illustrates an exemplary radial menu 300, according to an embodiment of the invention. In one embodiment, the radial menu 300 may be displayed in an application window 100 by the menu manager 215, as illustrated in Figure 3. However, in alternative  
5       embodiments, the menu manager 215 may be configured to display the radial menu 300 at any location on a screen, whether inside or outside a window.

In general, the radial menu 300 may include a center 310 and a plurality of radial menu items 320 placed radially outwards from the center 310. For purposes of illustration, the radial menu 300 is assumed to be associated with an image editing software. Accordingly, the radial menu items 320 displayed in Figure 3 include “Previous Image”, “Next Image”, “Annotate”, “Rotate Clockwise”, “Rotate Counterclockwise”, “Save”, “Exit”, and “Delete”.  
10       In a particular embodiment, the radial menu 300 may include between 6 and 8 radial menu items, however, any reasonable number of radial menu items may be included in the radial menu 300 in other embodiments.  
15

The radial menu items 320 may be selected by using a screen pointer such as, for example, a mouse pointer, a stylus pen, trackball pointer, and the like, as is described in greater detail  
20       below. Each of the radial menu items 320 may be associated with commands and/or functions that may be used to communicate with an application 114 associated with the radial menu 300. For example, the “Next Image” radial menu item, when selected, may cause a new image to be displayed in an application content area 130 of window 100 in Figure 3. As another example, the “Annotate” radial menu item, when selected, may launch  
25       a function that may allow a user to insert annotations for an image displayed in the application content area 130. In some embodiments, selecting a radial menu item may result in a second or cascaded radial menu to be displayed.

In one embodiment of the invention, the radial menu items 320 may be displayed as a “pie slices” 320, as illustrated in Figure 3. However, in alternative embodiments, the radial menu items may have any reasonable shape that allows a plurality of radial menu items 320 to be displayed radially outwards from the center 310. Figures 4A and 4B, illustrate some  
30

alternative shapes for the radial menu items 320. Furthermore, while a circular radial menu 300 is illustrated in Figure 3, in alternative embodiments, the radial menu 300 may be semicircular, quadra circular, or any other radial shape. For example, Figure 4C illustrates a semicircular radial menu, according to an embodiment of the invention.

The radial menu 300 may be a pop-up menu that is displayed upon the occurrence of a predefined screen pointer event. For example, in one embodiment, the menu manager 215 may be configured to display the radial menu 300 on a screen (for example, in window 100) upon detecting a mouse click. In a particular embodiment, the radial menu 300 may be displayed when a right button of a mouse is clicked. While using mouse clicks to display radial menus is described herein, alternative screen pointer events that may cause a radial menu to appear may include, for example, touching a screen with a stylus pen or finger, pressing one or more keys on a keyboard, receiving a voice command, and the like.

In one embodiment of the invention, the menu manager 215 may display the radial menu such that the center of the radial menu aligns with the screen pointer. Figure 5 illustrates a radial menu 300 displayed such that the center 310 of the radial menu 300 aligns with a location 520 of a screen pointer 510. As illustrated in Figure 5, the screen pointer may be a mouse pointer and the location 520 may be a location of the mouse pointer when the mouse is clicked. Alternatively the location 520 may be the location where a stylus pen or finger touches a display screen.

Selection of a radial menu item from a radial menu may involve moving the screen pointer 510 in the direction of a desired radial menu item 320. For example, to select the “Annotate” radial menu item, the screen pointer may be moved straight up (in a generally 90 degrees direction) towards the pie slice of the “Annotate” radial menu item. The moving of the screen pointer on the display screen is generally referred to hereinafter as a “stroke” or a gesture (the terms gesture and stroke are used interchangeably herein). In the case of a mouse pointer, strokes may be performed by simply moving the mouse on a mouse pad. While using a stylus pen or finger on a touch screen, the finger or stylus pen may simply be dragged across the screen to perform a stroke.

The gestures used for selecting radial menu items may be selected from a predefined set of gestures. The predefined set of gestures may include any combination of simple and/or complex predefined gestures. In other words, a wide range of different gestures may be defined to facilitate interaction between a user and the radial menu. As an example, simple gestures may include movement of a screen pointer in a single direction. Complex gestures may include movement of a screen pointer in multiple directions. In one embodiment, performing the gestures may also include other screen pointer events such as, for example, button click downs, button release, and the like. For example, in some embodiments, the gestures may be performed while a mouse button is clicked down. Alternatively, in other embodiments, the gestures may be performed before, after, or in between one or more screen pointer events such as, for example, in between mouse button click down and releases.

In one embodiment, placing the screen pointer over a radial menu item 320 may cause the radial menu item to become active. When a radial menu item 320 is active, the occurrence of a selection event, such as, for example, a mouse click, may cause the radial menu item 320 to be selected. In one embodiment of the invention, the menu manager 215 may be configured to provide a visual indication to identify an active radial menu item.

Figure 6 illustrates an exemplary stroke 610 which results in the activation of a radial menu item, according to an embodiment of the invention. As illustrated in Figure 6, the stroke 610 moves the screen pointer over the "Annotate" radial menu item. As a result, the menu manager 215 may change the background color of the "Annotate" pie slice, which is indicated by the shading of the "Annotate" pie slice in Figure 6. The change in color may identify the "Annotate" radial menu item as the active item. Other methods for providing a visual indication such as, for example, bold facing the letters of the active radial menu item, dimming or fading the pie slices or letters of non-active radial menu items, and the like, are also contemplated. While a straight line stroke is illustrated in Figure 6, the stroke 610 may include any movement in any and/or multiple directions on a display screen in alternative embodiments.

In one embodiment, the center 310 of the radial menu 300 may be an inactive center. In other words, no radial menu items 320 may be active while the screen pointer 510 lies over

the center portion 310. Therefore, when the menu manager 215 aligns the center 310 of the radial menu when the radial menu is displayed as described above, no radial menu items 320 may be initially active. Thereafter, user strokes may cause one or more radial menu items to become active. If the user strokes return the screen pointer to the center 310, all radial menu items may again become inactive.

One embodiment of the invention may allow radial menu items 320 to be selected using multiple gestures. In some embodiments, the gestures may include one or more screen pointer events such as, for example, mouse click downs (pressing a mouse button), mouse click offs (releasing the mouse button), touching a screen with a stylus pen or finger, removing stylus pen or finger from the screen and the like. The menu manager 215 may be configured to analyze gestures performed on a display screen to determine whether a radial menu item is selected. In one embodiment, a plurality of predefined gestures may correspond to respective menu item selections.

For example, exemplary gestures for selecting a radial menu item may include performing a first mouse click, i.e., a mouse button click down and release. The first mouse click may display a radial menu, for example, the radial menu 300 on the display screen. Thereafter, one or more gestures may be performed to move the mouse pointer over a desired radial menu item 320. As discussed above, menu manager 215 may provide a visual indication that the desired radial menu item is active. When the mouse pointer is over the desired radial menu item, the mouse may be clicked a second time. Because the second mouse click occurred while the mouse pointer is above a radial menu item 320, the menu manager may determine that a radial menu item selection has occurred. Therefore, the menu manager 215 may cause a command or function associated with the selected radial menu item to be executed.

In one embodiment of the invention, the gestures for selecting a radial menu item may include a first mouse click (i.e., a mouse click down and release) that causes a radial menu to be displayed on the display screen, a first gesture configured to activate a radial menu item, and a predefined second gesture that is configured to select the radial menu item. Figure 7A illustrates exemplary first and second gestures according to an embodiment of the invention.

As illustrated in Figure 7A, a first gesture 710 may move the screen pointer 510 from a center 310 of the radial menu to the “Annotate” radial menu item. Thereafter, a predefined second gesture may be performed to select the “Annotate” radial menu item. As illustrated in Figure 7A, predefined second gesture may involve moving the screen pointer in a zigzag back and forth motion over a same path. If the predefined back and forth motion is detected by the menu manager while the screen pointer is over a radial menu item, the radial menu item may be selected.

Any reasonable predefined movement of the screen pointer 510 may be used as a radial menu selection event. Figure 7B illustrates an alternative predefined second motion that may result in the selection of a radial menu item. As illustrated in Figure 7B, a first gesture may move the screen pointer 510 from a center 310 of the radial menu to the “Annotate” radial menu item. A predefined second gesture may move the screen pointer back in a direction towards the center 310, which may result in the selection of the “Annotate” radial menu item. Still another alternative predefined second gestures may include substantially circular and/or semi-circular movement of the screen pointer over the radial menu item.

In another embodiment, the gestures for selecting a radial menu item may involve a mouse button click down (without release), a first gesture for activating a radial menu item, and a second predefined gesture for selecting the radial menu item. The mouse button may be released after selection of the radial menu item. The mouse button click down may cause a radial menu to be displayed. The first gesture and predefined second gesture may function as described above.

In some embodiments, if a second predefined gesture is not received within a predefined period of time after activation of the radial menu, the menu manager 215 may be configured to close the radial menu. Closing the radial menu may involve removing the radial menu from the display screen. In some embodiments, the predefined period of time may begin after completion of the first gesture, e.g., after the screen pointer stops moving. For example, a screen pointer event may cause the radial menu to be displayed. Thereafter, a first gesture may be completed to activate a radial menu item. If the predefined second



gesture is not received within the predefined period of time after completion of the first gesture, the radial menu may be closed by the menu manager 215.

5 In yet another embodiment, the menu manager 215 may select an active radial menu item if the radial menu item has been active for a predefined period of time. Accordingly, the gesture for selecting a radial menu item may involve a mouse button click down (with or without release), and a first gesture for activating a radial menu item. The mouse button click down may cause a radial menu to be displayed. The first stroke may function as described above to activate a radial menu item. The menu manager 215 may monitor the  
10 time for which a particular radial menu item has been active, and select the radial menu item after the predefined period of time.

While the first gesture is illustrated as a straight line from the center 310 of the radial menu to a desired radial menu element 320, in some embodiments, the first gesture may include  
15 movement along any part of the display screen. For example, a user may initially move the screen pointer in the direction of a first radial menu item, but then decide to choose a second radial menu item instead. Accordingly, the user may move the screen pointer across the screen until the desired second radial menu item is activated. Once the second radial menu item is activated, the user may perform the predefined second gesture to select the second  
20 radial menu item.

Figure 7C illustrates exemplary first and second gestures according to another embodiment of the invention. As illustrated in Figure 7C, the first gesture 710 may include an initial movement towards a first radial menu item ("Annotate"). The first stroke 710 may continue  
25 to move across the screen until a second radial menu item ("Delete") is activated, as indicated by the shading. Thereafter, a predefined second gesture 720 may be performed to select the second radial menu item. In some embodiments, the first gesture may include movement over multiple radial menu items until a desired radial menu item is activated.

30 In one embodiment of the invention, gestures for selecting a radial menu item may include a first mouse click (i.e., a mouse click down and release) that causes a radial menu to be displayed on the display screen, and a first gesture configured to activate and select the

radial menu item. The first gesture may activate a menu item 320 when the mouse pointer is moved thereon. Furthermore, the menu manager 215 may be configured to analyze a speed of the screen pointer during the first stroke. If the speed exceeds (or falls below) a predefined threshold value, the activated radial menu item may be selected. The threshold speed values may be user configurable in some embodiments. For example, the threshold speed values may be defined by a user in the user preferences 221 (See Figure 2).

In one embodiment of the invention, different gestures may be defined for interacting with different parts of the radial menu. For example, in one embodiment, a first predefined stroke may be defined for selecting radial menu items located on a first side, for example, the right side of the radial menu, and a second predefined stroke may be defined for selecting radial menu items located on a second side, for example, the left side of the radial menu. In alternative embodiment, the same stroke may result in different results in different parts of the radial menu. For example, in one embodiment, a predefined stroke performed on a first side of the radial menu may result in the activation of a radial menu item. However, performing the same predefined stroke on a second side of the radial menu may result in a radial menu item being selected.

In one embodiment of the invention, each pie slice of the radial menu may be overloaded with two or more radial menu items. Figure 7D illustrates an exemplary radial menu 700 comprising a plurality of pie slices 730. As illustrated in Figure 7D, each pie slice 730 may include a first radial menu item 751 and a second radial menu item 752. In one embodiment of the invention, a gesture for selecting a first radial menu item 751 may include a first mouse click (i.e., a mouse click down with or without release) that causes a radial menu to be displayed on the display screen, a first stroke configured to activate the first radial menu item 751, and a corresponding second radial menu item 752, and a predefined second stroke configured to select the first radial menu item 751. An exemplary predefined second stroke may include a stroke in a clockwise direction. A gesture for selecting a second radial menu item 751 may include a first mouse click (i.e., a mouse click down with or without release) that causes a radial menu to be displayed on the display screen, a first stroke configured to activate the second radial menu item 752 and a corresponding first radial menu item 751,

and a predefined third stroke configured to select the second radial menu item 751. An exemplary predefined third stroke may include a stroke in the counter-clockwise direction.

5 In one embodiment of the invention, a user may be allowed to define the particular gestures for selecting items from a radial menu. For example, in one embodiment, the application 114 may be configured to display a graphical user interface that allows a user to define a gesture for selecting radial menu items. The user defined gesture may be stored in the user preferences 221, in one embodiment. Figure 7E illustrates an exemplary graphical user interface for defining a gesture for selecting radial menu items. As illustrated in Figure 7E,  
10 the user preferences 221 may include a first column for defining screen pointer movement (or strokes), a second column 762 for defining mouse button input, and a third column 763 for defining an action performed based on the defined inputs in columns 761 and 762.

As illustrated in Figure 7E, the GUI 760 may include a plurality of drop down menus 767 for  
15 defining the particular inputs and the actions performed in response to the inputs. Alternatively, the GUI may include radio buttons, text boxes, check boxes, and the like for defining the inputs and actions. In some embodiments, the GUI 760 may include a screen where the input (for example, strokes and mouse clicks) may be performed to define the inputs and/or actions.

20 The first row 764 defines an exemplary screen pointer event, i.e., right mouse button click down, that results in a radial menu being displayed. Alternatively, a right mouse button click down and click off may also be selected as a predefined screen pointer event for displaying a radial menu. As can be seen in row 764 of Figure 7E, the no screen pointer movement has been defined. In alternative embodiments, the user may define a screen  
25 pointer movement for displaying the radial menu instead of (or in addition to) the right button mouse click down.

30 Row 765 illustrates inputs for activating radial menu items. As illustrated, radial menu items may be activated when the right mouse button is held down and the screen pointer is moved in any direction as illustrated by the symbol in row 765, column 761. Alternatively, a user may choose to select a straight line movement of the screen pointer for selecting radial menu

items. Row 766 illustrates a predefined second stroke, i.e., a circular stroke, for selecting a radial menu item. Row 767 illustrates a mouse button click off. While no action is shown for the mouse button click off on Figure 7E, in some embodiments, the mouse button click off may result in predefined action, for example, selection of the radial menu item, removing of the radial menu from the display screen, or the like.

In one embodiment of the invention, it may be possible to select radial menu items even though a selection event occurs outside the bounds of the radial menu. Figure 8 illustrates an exemplary radial menu 300 comprising a plurality of extra-territorial zones 8101-8 associated with respective radial menu items 320. As shown in Figure 8, the zones 8101-8 may be outside the visible bounds of the radial menu 300. As shown in Figure 8, the outside bounds of the radial menu 300 are demarcated by a circle 301. The circle 301 is merely illustrative. In other embodiments, any visible geometric shape 301 is contemplated. In one embodiment of the invention, if a screen pointer is in a zone 810, the radial menu item 320 associated with the zone 810 may be active. Accordingly, if a selection event occurs in the zone 810, a selection of the radial menu item associated with the zone 810 may occur. In other words, a pie slice of the radial menu item 320 and a respective zone 810 may define a selection zone of a radial menu item within which gestures may be performed for selection of the radial menu item.

For example, Figure 8 illustrates a first stroke 810 which moves the screen pointer 510 across the "Annotate" radial menu item pie slice and into the zone 8103 associated with the "Annotate" radial menu item. As can be seen in Figure 8, the "Annotate" radial menu item remains active even though the screen pointer is outside the bounds of the radial menu 300. Further as depicted in Figure 8, a predefined second stroke 720 may occur in the zone 8103 associated with the "Annotate" radial menu item. The menu manager 215 may detect the predefined second stroke in the zone 8103 and cause the respective "Annotate" radial menu item to be selected.

Allowing users to make elongated first strokes such as, for example, the elongated first stroke 710 in Figure 8 may reduce errors in selection of radial menu items. As can be seen in Figure 8, the further the screen pointer is moved from the center 310 of the radial menu,

the greater the area that is available for making gestures such as, for example, the predefined second gestures. By providing greater area for gestures, the probability of gesture strokes accidentally moving into zones 810 of undesired radial menu items may be reduced.

5 Furthermore, activating radial menu items as a user performs a first stroke that is outside the bounds of the radial menu item may allow greater precision in the activation of a desired radial menu item. For example, the further the screen pointer 510 is from the center 310, the greater the radial distance that must be travelled by the screen pointer 510 to a zone 810 of an adjacent radial menu item. One skilled in the art will appreciate that allowing a user to  
10 move the screen pointer in a wider arcs around the radial menu allows increased precision in activating desired radial menu items.

As illustrated in Figure 8, in some embodiments the zones 810 may extend to the edges of a display area, for example, to the edges of a display screen, an application window, or the  
15 like. In an alternative embodiment, a predefined limited selection zone may be defined outside the bounds of the radial menu for receiving selections of radial menu items. Figure 9 illustrates a circular perimeter 900 around the radial menu 300 that defines a plurality of zones 9101-8 for each of the radial menu items 320. In one embodiment, the perimeter may be made visible to the user, for example, by displaying a solid line, dashed line, shading the  
20 zones 910, or the like. The perimeter 900 may have a predefined distance  $d$  from the center 310 of the radial menu 300. For example, the perimeter  $d$  may be defined by a user in the user preferences 221 illustrated in Figure 2. While a circular perimeter is shown herein, in alternative embodiments the perimeter 900 may have any reasonable shape that encompasses the radial menu 300. The dimensions of the perimeter may be user configurable in some  
25 embodiments.

In one embodiment of the invention, a predefined second stroke as described above, if performed within a zone 910, may result in the selection of a respective radial menu item 320. If a screen pointer is moved outside the perimeter 900, all radial menu items 320 may  
30 become inactive. Therefore, if the predefined second stroke is performed outside the perimeter 900, a radial menu item 320 may not be selected, thus creating a non-selective zone in the direction of a gesture if the user changes his/her mind regarding selection.

In one embodiment of the invention, selecting a radial menu item 320 may involve performing the first stroke followed by a predefined second stroke as described above. The first stroke may include moving the screen pointer in and out of the perimeter 900. An exemplary first stroke 710 is illustrated in Figure 9. As illustrated, the first stroke 710 may begin with a movement of the mouse pointer towards a first radial menu item (“Previous Image”). As the screen pointer is moved across the pie slice representing the first radial menu item and the zone 910 associated therewith, the menu manager 215 may activate the first radial menu item. However, when the screen pointer moves outside the perimeter 900, the first radial menu item may be deactivated by the menu manager 215.

As illustrated further in Figure 9, the first stroke may continue to move the screen pointer outside the perimeter 900 and reenter the perimeter 900 in a zone 910 associated with a second radial menu item (“Rotate Counterclockwise”). When the screen pointer enters the zone 910 associated with the second radial menu item, the menu manager 215 may activate the second menu item. However, when the screen pointer moves outside the perimeter 900 again, the second radial menu item may be deactivated by the menu manager 215.

The screen pointer may be moved in and out of the perimeter 900 several times as described above, which may result in the activation and deactivation of several radial menu items.

Figure 9, depicts the first stroke terminating in a selection zone of a third radial menu item (“Exit”), thereby activating the third radial menu item as illustrated. A predefined second stroke 720 associated with the activated menu item is also shown, which may result in the selection of the third radial menu item. In a particular embodiment, the selection may occur upon the release of a pressed mouse button.

In one embodiment of the invention, moving the screen pointer outside the perimeter 900 may result in the radial menu 300 being removed from the display screen. This may allow a user to cancel or remove the radial menu from the screen in a fluid gesture without additional actions. For example, if a user causes a radial menu to be displayed on the screen (by clicking a mouse button for example), and decides that he no longer wants to make a selection from the radial menu, the user may simply make an elongated straight line first stroke that would take the screen pointer outside the predefined perimeter 900. Upon

detecting that the screen pointer is outside the perimeter 900, the menu manager 215 may remove the radial menu from the display screen.

Figure 10 is a flow diagram of exemplary operations that may be performed by a menu manager 215, according to an embodiment of the invention. The operations may begin in step 1010 by receiving a predefined screen pointer event. Exemplary predefined screen pointer events may include, for example, a mouse click down, touching of a touch screen with a stylus pen or finger, and the like. In response to receiving the predefined screen pointer event the menu manager 215 may display a radial menu on a display screen, in step 1020.

In step 1030, the menu manager 215 may receive a first stroke of the screen pointer. As described above, the first stroke may include a movement of the screen pointer in any direction and/or multiple directions on the display screen. As the screen pointer moves across the screen during the first stroke, the menu manager may determine whether the screen pointer is within a predefined selection zone of one or more radial menu items of the radial menu in step 1040. The predefined selection zone may include the pie slices 320 as illustrated in Figure 3. In some embodiments, the predefined selection zone may also include the zones 910, as described with reference to Figure 9.

If the screen pointer is determined to be outside the predefined selection zone, all radial menu items may be deactivated in step 1050. On the other hand, if the screen pointer is within a predefined selection, zone a radial menu item associated with the predefined selection zone may be activated for selection in step 1060. In one embodiment, activating a radial menu item for selection may involve providing a visual indication that the radial menu item is active.

In step 1070, the menu manager 215 may receive a predefined second stroke, for example, the predefined second strokes 720 described with reference to Figures 7A and 7B. In response to receiving the predefined second stroke, the menu manager 215 may select a respective active radial menu item in step 1080. In one embodiment, selecting the radial

menu item may involve launching execution of a command or function associated with the selected radial menu item.

5 In one embodiment of the invention, after selection of a radial menu item, the menu manager 215 may remove the radial menu from the display screen. In a particular embodiment, after selection of a particular radial menu item, the radial menu may be removed from the display screen after a predefined period of time. In some embodiments, the radial menu may fade away during the predefined period of time.

10 During the predefined period of time after selection of a radial menu item during which the radial menu is displayed on the display screen, the user may be allowed to enter a predefined gesture to undo the selection in some embodiments of the invention. For example, in one embodiment, as the radial menu is fading away during the predefined time period, a predefined screen pointer event such as a mouse click, and/or a predefined stroke may undo  
15 the selection of the radial menu item.

#### RADIAL MENUS WITH VARIABLE ITEM AREAS

20 As described above, radial menus allow greater accuracy and speed in comparison to traditional drop down menus while making menu selections. The accuracy of selection in a radial menu may depend on the number of pie slices included therein. A greater number of pie slices results in smaller sized pie slices and a higher density of radial menu items in the radial menu. As a result, the probability of making an erroneous selection using the gestures described above may increase. In one embodiment, the number of pie slices may be limited  
25 to between 6 and 8 because, within this range, the greatest speed and accuracy of selection may be achieved.

30 One skilled in the art will recognize that including a fewer number of pie slices in the radial menu result in each pie slice being relatively larger. Larger pie slices have a higher probability of accurate selection because a larger amount of area is available for making screen pointer gestures for selecting the radial menu items. Conversely, smaller pie slices have a lower probability of accurate selection because the area available for making screen



pointer gestures is smaller. Therefore, it is easier to select radial menu items from larger pie slices in comparison to smaller pie slices. In the examples described hereinabove, the radial menus have been shown with a plurality of pie slices that have the same size. Therefore, each of the plurality of pie slices may have the same probability of accurate selection.

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In some embodiments, it may be desirable to make it easier to select some radial menu items and more difficult to select other radial menu items. For example, it may be desirable to make it easier to select radial menu items associated with commonly used functions. In another example, it may be desirable to make radial menu items associated with destructive functions, for example, the delete function, more difficult to select. Making a radial menu item more difficult to select may require a user to make a more conscious and concerted effort to select the radial menu item. Therefore, the probability of accidental selection of the difficult to select radial menu item may be reduced.

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Some embodiments of the invention may provide radial menus having variable sized pie slices in which the radial menu items may be placed. Therefore, it may be relatively easier to select radial menu items in larger pie slices in comparison to radial menu items in smaller pie slices. In one embodiment of the invention, each of a plurality of available radial menu items may have a selectability value associated therewith. The selectability value of a radial menu item may indicate the desired easiness of selection of the radial menu item. Any range of selectability values may be defined in one embodiment. For example, the selectability values may have a range of 1-10, wherein a selectability value of 1 indicates that the greatest difficulty of selection is desired, and a selectability value of 10 indicates that the least difficulty of selection is desired for the radial menu item. While numerical selectability values are described herein, in alternative embodiments, the selectability value may be of any other reasonable type. For example, in one embodiment, the selectability value may be a boolean value, e.g., easy or difficult.

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In the following examples, the terms “higher selectability value” and “lower selectability value” are used in reference to the selectability values of radial menu items. For purposes of this specification, a higher selectability value is assumed to indicate lower difficulty in selecting an associated radial menu item, and a lower selectability value is assumed to

indicate a greater difficulty in selecting an associated radial menu item. However, in alternative embodiments, the opposite may be true. I.e., a higher selectability value may indicate greater difficulty in selecting an associated radial menu item, and a lower selectability value indicates a lower difficulty in selecting an associated radial menu item.

5

The selectability values of the radial menu items may be defined in the user preferences 221 in one embodiment of the invention, and therefore, may be modified by a user. In alternative embodiments, the selectability value may be determined based on historic selection of the radial menu items 222. In such embodiments, the menu manager 215 may be configured to maintain the historic selection data for each of the radial menu items 222 and compute a selectability value for each item based on the historic selection data.

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While determining selectability values based on historic selection data, probability of selection, the nature of a function associated with the radial menu item, and the like are disclosed herein, in alternative embodiments, any criteria may be used to determine the selectability value. Exemplary criteria may include, for example, the length of time associated with execution of a function associated with a radial menu item, a corresponding expense, reversibility of the function, safety of execution of the function, and the like.

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In one embodiment of the invention, the menu manager 215 may be configured to display a radial menu having a predefined number of pie slices of each of a plurality of dimensions. Figure 11 illustrates an exemplary radial menu 1100 comprising a first plurality of pie slices 1110 and a second plurality of pie slices 1120. As shown in Figure 11, the first plurality of pie slices 1110 may be larger in area compared to the second plurality of pie slices 1120.

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While pie slices of two different sizes 1110 and 1120 are shown herein, in alternative embodiments, pie slices of any number of different dimensions may be displayed in the radial menu 1100.

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In one embodiment, the first plurality of pie slices 1110 and the second plurality of pie slices 1120 may be arranged in an alternating manner, as illustrated in Figure 11. The pie slices may be arranged in an alternating manner so that the variable sized pie slices are arranged substantially in the same orientation as same-sized pie slices. However, in other

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embodiments, any reasonable arrangement of the pie slices 1110 and 1120 may be possible. For example, in a particular embodiment, all the first pie slices 1110 may be placed adjacent to one another and all the second pie slices 1120 may be placed adjacent to one another.

5 In one embodiment of the invention, the menu manager 215 may be configured to place radial menu items having a relatively higher selectability value in larger pie slices and radial menu items having lower selectability values in the smaller pie slices. For example, radial menu items A, C, E, and G may have relatively higher selectability values than the radial menu items B, D, F, and H. Accordingly, radial menu items A, C, E, and G may be placed  
10 in the pie slices 1110 and the radial menu items place radial menu items B, D, F, and H may be placed in the pie slices 1120. By placing the radial menu items with a higher selectability value in the larger pie slices 1110, the menu manager 215 may allow a user a greater range of motion for performing gestures to select radial menu items in the pie slices 1110. In other words, it is easier to select the radial menu items in the pie slices 1110 in comparison to the  
15 radial menu items in the pie slices 1120.

As discussed above, radial menus may be displayed in a display screen when a predefined screen pointer event for displaying a radial menu is detected. As described above, the particular radial menu items displayed in the radial menu may depend on, for example, a  
20 location of the screen pointer on the screen, a screen object over which the predefined screen pointer occurs, or the like. Therefore, in one embodiment of the invention, the menu manager 215 may be configured to determine the particular radial menu items that are to be displayed in a radial menu 1100 upon receiving a predefined screen pointer event for displaying a radial menu. The menu manager 215 may then retrieve the selectability values  
25 associated with each of the determined radial menu items. Thereafter, the menu manager 215 may place the radial menu items in the pie slices 1110 and 1120 based on the retrieved selectability values of the radial menu items.

Figure 12 is a flow diagram of exemplary operations performed by the menu manager while  
30 placing radial menu items in a radial menu. The operations may begin in step 1210 by receiving a predefined screen pointer event for displaying a radial menu. In step 1220 the menu manager 215 may determine a plurality of radial menu items that will be displayed in

the radial menu. The plurality of radial menu items may be determined based on, for example, on a location of the screen pointer in the display screen, a particular screen object over which the screen pointer event occurs, or the like.

5 In step 1230, the menu manager 215 may retrieve selectability values associated with each of the radial menu items. The menu manager may then place the radial menu items in pie slices of the radial menu having different sizes based on the selectability values of the radial menu items.

10 In one embodiment of the invention, each selectability value that may be assigned to a radial menu item may be associated with a particularly dimensioned pie slice of a set of different possible dimensions for the pie slices in a radial menu. For example, in one embodiment, the radial menu items of a radial menu may have one of three possible selectability values. As an example, the “delete” radial menu item may be associated with a first selectability  
15 value, the “save” radial menu item may be associated with a second selectability value, and the “print” radial menu item may be associated with a third selectability value.

Each of the selectability values may correspond to a different sized pie slice that may be placed in the radial menu. For example the first selectability value may be associated with a  
20 pie slice having first dimensions, the second selectability value may be associated with a pie slice having second dimensions, and the third selectability value may be associated with a pie slice having third dimensions. Accordingly, radial menu items having the first, second and third selectability values may only be placed in pie slices having corresponding dimensions.

25 For example, in one embodiment, a radial menu that is displayed on a display screen may include a plurality of each of pie slices having the first, second, and third dimensions. Accordingly, the “delete” radial menu item may only be placed in a pie slice having the first dimensions, the “save” radial menu item may only be placed in a pie slice having the second  
30 dimensions, and the “print” radial menu item may only be placed in a pie slice having the third dimensions.

In one embodiment of the invention, the menu manager 215 may be configured to dynamically determine the size of pie slices in the radial menu based on the relative selectability values of radial menu items to be displayed in the radial menu. In a particular embodiment, the size of each pie slice of the radial menu item may be determined by an angle created by two straight sides of the pie slice. In one embodiment, the angle of each pie slice may be determined based on the following formula.

$$\text{Pie Angle} = \frac{\text{selectability value of radial menu item}}{\text{sum of selectability values of all radial menu items}} \bullet 360 \text{ degrees}$$

As an example, assume that three radial menu items “delete”, “save”, and “print” are to be placed in the radial menu. Further assume that the “delete” radial menu item has a selectability value of 1, the “print” radial menu item has a selectability value of 2, and the “save” radial menu item has a selectability value of 3. Using the formula above, the angle for the pie slice in which the “delete” radial menu item will be placed may be  $(1/6) \cdot 360 = 600$ . The angle for the pie slice in which the “print” radial menu item will be placed may be  $(2/6) \cdot 360 = 1200$ , and the angle for the pie slice in which the “save” radial menu item will be placed may be  $(3/6) \cdot 360 = 1800$ .

Figure 13 illustrates an exemplary radial menu 1300 comprising pie slices 1310, 1320, and 1330 that are dimensioned according to the above calculations. As illustrates, the pie slice 1310 includes the “save” radial menu item. Accordingly, pie slice 1310 is dimensioned with a 1800 angle between the straight sides 1311 and 1312. The pie slice 1320 includes the “print” radial menu item. Accordingly, pie slice 1320 is dimensioned with a 1200 angle between the straight sides 1311 and 1313. The pie slice 1330 includes the “delete” radial menu item. Accordingly, pie slice 1330 is dimensioned with a 600 angle between the straight sides 1312 and 1313.

### OVERLAPPING RADIAL MENU PIE SLICES

In one embodiment of the invention, different sized radial menu pie slices may be placed over each other in an overlapping manner in the radial menu. Figure 14 illustrates an

exemplary radial menu 1400 according to an embodiment of the invention. The radial menu 1400 may include a plurality of pie slices 1410a-h. In one embodiment of the invention, when the radial menu is initially displayed, each of the pie slices 1410a-h may have the same shape. For example, each of the pie slices 1410a-h may have an angle X between the lines  
5 dividing the pie slices in the radial menu, as illustrated in Figure 14.

In alternative embodiments, each of the pie slices 1410 may be shown having different sizes. For example, the pie slices may be arranged, as shown in Figure 11. Regardless of whether the pie slices are initially shown having the same size or different sizes, in one embodiment  
10 of the invention, each pie slice may have at least two possible sizes associated therewith. Specifically, each pie slice may have a non-activated size and an activated size. The pie slice may be shown with the non-activated size in the radial menu when a radial menu item in the pie slice is not activated by a screen pointer. On the other hand, the pie slice may be shown with the activated size when the radial menu item is activated by a screen pointer, as  
15 is described below.

For example, as shown in Figure 14, the pie slice 1410a has a first size determined by the angle X. The first size may be a non-activated size because none of the radial menu items are shown as activated. In Figure 14, the shaded area illustrates the non activated size of pie  
20 slice 1410a. Figure 14 also illustrates dashed lines 1411 with an angle Y, therebetween, which illustrate an activated size for the pie slice 1410a.

As described above, when a screen pointer is moved over a selection zone of a radial menu, for example, over the pie slice 1410a, the radial menu item may be activated. In one  
25 embodiment, when a radial menu item is activated, the size of the pie slice 1410 including the activated radial menu item may be changed to its respective activated size. For example, Figure 15 illustrates a gesture 1510 that moves a screen pointer 1550 over the pie slice 1410a, thereby activating the radial menu item A. As a result of activating the radial menu item A, the size of pie slice 1410a is changed to its respective activated size. The shaded  
30 area in Figure 15 illustrates the activated size of pie slice 1410a.

As illustrated in Figure 15, after activation of radial menu item A, the lines 1411 and the angle Y define the pie slice 1410a. The angle X and the dashed lines 1511 illustrate the size of the pie slice 1410a prior to activation of the radial menu item A. Because the pie slice 1410a is bigger after activation, the selection area for performing gestures to select the radial menu item A also becomes greater, thereby making it easier to select the radial menu item A. In other words, the selection zone for the radial menu item A becomes greater upon activation, thereby making it easier to select the radial menu item A.

While a pie slice 1410a with an activated size greater than its non-activated size is disclosed herein, in alternative embodiments, the activated size of a pie slice may be smaller than its non-activated size. Whether the activated size is greater or smaller than the non-activated size may depend on a desired accuracy in selection of the radial menu item. For example, if a greater accuracy is desired (difficulty in selection), the activated size may be smaller than the non-activated size. On the other hand, if lower accuracy is desired, then the activated size may be greater than the non-activated size.

Displaying a radial menu pie in its respective activated size may result in a change in the size of one or more adjacent pie slices. For example, referring to Figure 15, the activation of the pie slice 1410a results in the sizes of pie slices 1410b and 1410h to become smaller because the pie slice 1410a overlaps the pie slices 1410b and 1410h. Of course, if the activated size of pie slice 1410a is smaller than its respective non-activated size, the size of pie slices 1410b and 1410h would become larger upon the activation of the pie slice 1410a. Changing the size of the adjacent pie slices may result in a corresponding change in the selection zone of the slices.

In one embodiment of the invention, the activated and non-activated size of a pie slice may depend on a selectability value of a radial menu item included therein. For example, if a radial menu item with a high selectability value is placed in a pie slice, the activated size of the pie slice may be greater than the non-activated size. Conversely, if a radial menu item with a low selectability value is placed in a pie slice, the activated size of the pie slice may be smaller than the non-activated size. In one embodiment, the selectability value of a radial menu may be used to determine the exact activated size of a pie slice. For example, the

selectability value may determine the angle between lines separating the pie slices, as described by the equation provided in the previous section.

5 In one embodiment of the invention, a pie slice of a radial menu item may remain in the activated size until a screen pointer moves out of the selection zone as defined by the activated pie slice. For example, in Figure 15, so long as the screen pointer remains within the shaded selection zone between the lines 1411, the radial menu item A may remain activated. For example, the gesture 1510 moves the screen pointer 1510 outside of the bounds of the lines 1511 (but within the lines 1411), however, the radial menu item A  
10 remains active. Therefore, in some embodiments, the entire shaded region between the lines 1411 in Figure 15 may be available to perform a predefined gesture for selecting a radial menu item to select the radial menu item A.

15 In one embodiment, when the screen pointer moves out of the bounds of an activated pie slice, the size of the pie slice may be changed back to its respective non activated pie size. Figure 16 illustrates a gesture 1610 that moves the screen pointer 1550 out of the bounds of an activated pie slice 1410a into a selection zone of a pie slice 1410b, thereby activating the pie slice 1410b and reverting the pie slice 1410a from its activated size to a non-activated size. In Figure 16, the lines 1511 demarcate the activated size of the pie slice 1410a. After  
20 the pointer 1550 moves outside the bounds of a line 1511, the size of the pie slice 1410 is changed back to its non-activated state as defined by the lines 1411.

In one embodiment of the invention, activation of the pie slice 1410b may result in the pie slice 1410b being shown in a respective activated size. Because the activated size of the pie  
25 slice 1410b may be larger (or smaller) than its non-activated size, the pie slice 1410b may overlap portions of the pie slice 1410a. Therefore, when the pointer 1550 activates the pie slice 1410b, the size of pie slice 1410a may be changed to a size other than its non-activated size in some embodiments.

30 By providing a radial menu with variable sized pie slices, embodiments of the invention facilitate fast and efficient selection of menu items in comparison to traditional radial menus.



While the foregoing is directed to embodiments of the present invention, other and further embodiments of the invention may be devised without departing from the basic scope thereof, and the scope thereof is determined by the claims that follow.

## CLAIMS

1. A method for displaying a radial menu, comprising configuring one or more processors to perform an operation comprising:

5 displaying, on a screen of an output device, a radial menu comprising a plurality of pie slices, each pie slice defining a selection zone for a respective radial menu item, wherein a first pie slice of the plurality of pie slices has a first predefined size;

receiving a first gesture that moves a screen pointer over the first pie slice on the screen, thereby activating the first pie slice of the radial menu; and

10 in response to the activation of the first pie slice, executing a menu manager on one or more of the processors to change a size of the first pie slice from the first predefined size to a second predefined size.

2. The method of claim 1, wherein the second predefined size is greater than the first predefined size.

3. The method of claim 2, wherein changing the size of the first pie slice from the first predefined size to the second predefined size comprises overlapping at least a portion of one or more pie slices adjacent to the first pie slice with the activated first pie slice.

4. The method of claim 3, further comprising:

receiving at least a portion of a predefined second gesture in the portion of the pie slices adjacent to the first pie slice that are overlapped by the activated first pie slice; and

25 selecting a radial menu item corresponding to the first pie slice in response to receiving the gesture.

5. The method of any preceding claim, further comprising:

receiving a third gesture that moves the screen pointer outside a bounds of the activated first pie slice having the second predefined size; and

30 upon receiving the third gesture, changing the size of the first pie slice from the second predefined size to a third size.

6. The method of claim 5, wherein the third size is the same as the first predefined size.

7. The method of any preceding claim, wherein a size of each of the pie slices is determined based on a weight value of a respective radial menu item.

8. The method of claim 7, wherein a radial menu item having a relatively greater weight value is displayed in a relatively larger pie slice.

9. The method of any preceding claim, wherein a size of each of the pie slices is determined based on whether or not a respective radial menu item is activated.

10. A computer readable storage medium comprising a program product which, when executed, is configured to perform an operation for displaying a radial menu, the operation comprising:

displaying, on a screen of a display device, a radial menu comprising a plurality of pie slices, each pie slice defining a selection zone for a respective radial menu item, wherein a first pie slice of the plurality of pie slices has a first predefined size;

receiving a first gesture that moves a screen pointer over the first pie slice on the screen, thereby activating the first pie slice of the radial menu; and

in response to the activation of the first pie slice, changing a size of the first pie slice from the first predefined size to a second predefined size.

11. The computer readable storage medium of claim 10, wherein the second predefined size is greater than the first predefined size.

12. The computer readable storage medium of claim 11, wherein changing the size of the first pie slice from the first predefined size to the second predefined size comprises overlapping at least a portion of one or more pie slices adjacent to the first pie slice with the activated first pie slice.

13. The computer readable storage medium of claim 12, wherein the operation further comprises:

receiving at least a portion of a predefined second gesture in the portion of the pie slices adjacent to the first pie slice that are overlapped by the activated first pie slice; and selecting a radial menu item corresponding to the first pie slice in response to receiving the gesture.

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14. The computer readable storage medium of any of claims 10 to 13, wherein the operation further comprises:

receiving a third gesture that moves the screen pointer outside a bounds of the activated first pie slice having the second predefined size; and

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upon receiving the third gesture, changing the size of the first pie slice from the second predefined size to a third size.

15. The computer readable storage medium of claim 14, wherein the third size is the same as the first predefined size.

15

16. The method of any of claims 10 to 15, wherein a size of each of the pie slices is determined based on a weight value of a respective radial menu item.

17. The method of claim 16, wherein a radial menu item having a relatively greater weight value is displayed in a relatively larger pie slice.

20

18. The method of any of claims 10 to 17, wherein a size of each of the pie slices is determined based on whether or not a respective radial menu item is activated.

19. A system, comprising:

a memory comprising a program; and

a processor which, when executing the program, is configured to:

display, on a screen of an output device, a radial menu comprising a plurality of pie slices, each pie slice defining a selection zone for a respective radial menu item, wherein a first pie slice of the plurality of pie slices has a first predefined size;

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receive a first gesture that moves a screen pointer over the first pie slice on the screen, thereby activating the first pie slice of the radial menu; and

in response to the activation of the first pie slice, change a size of the first pie slice from the first predefined size to a second predefined size.

20. The system of claim 19, wherein the second predefined size is greater than the first predefined size.

21. The system of claim 20, wherein changing the size of the first pie slice from the first predefined size to the second predefined size comprises overlapping at least a portion of one or more pie slices adjacent to the first pie slice with the activated first pie slice.

22. The system of claim 21, wherein the processor is further configured to:  
receive at least a portion of a predefined second gesture in the portion of the pie slices adjacent to the first pie slice that are overlapped by the activated first pie slice; and  
select a radial menu item corresponding to the first pie slice in response to receiving the gesture.

23. The system of any of claims 19 to 22, wherein the processor is further configured to:  
receive a third gesture that moves the screen pointer outside a bounds of the activated first pie slice having the second predefined size; and  
upon receiving the third gesture, change the size of the first pie slice from the second predefined size to a third size.

24. The system of claim 23, wherein the second predefined size is greater than the first predefined size.

25. The system of any of claims 19 to 24, wherein a size of each of the pie slices is determined based on a weight value of a respective radial menu item.

26. The system of claim 25, wherein a radial menu item having a relatively greater weight value is displayed in a relatively larger pie slice.

27. The system of any of claims 19 to 26, wherein a size of each of the pie slices is determined based on whether or not a respective radial menu item is activated.

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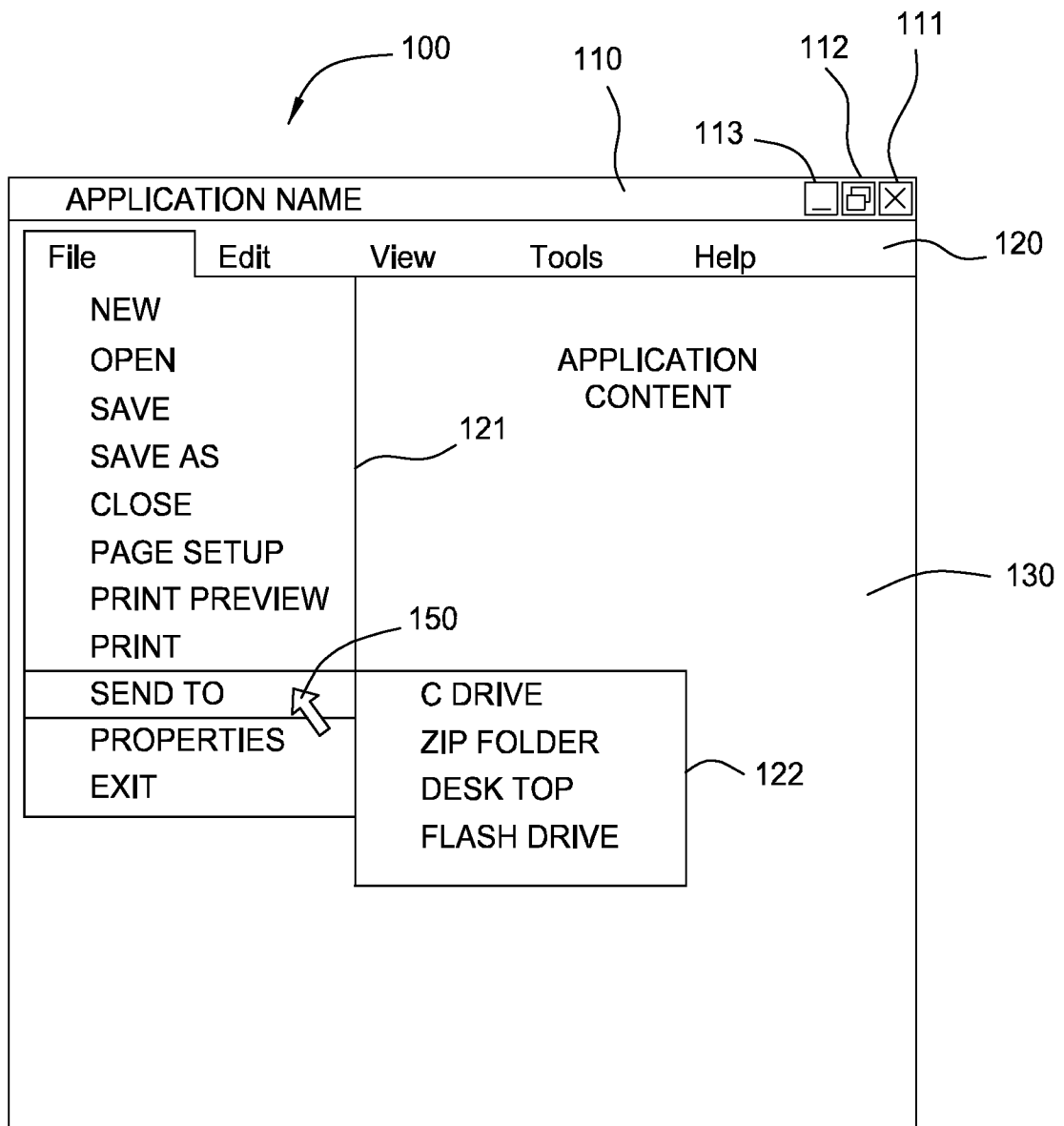


FIG. 1  
(PRIOR ART)

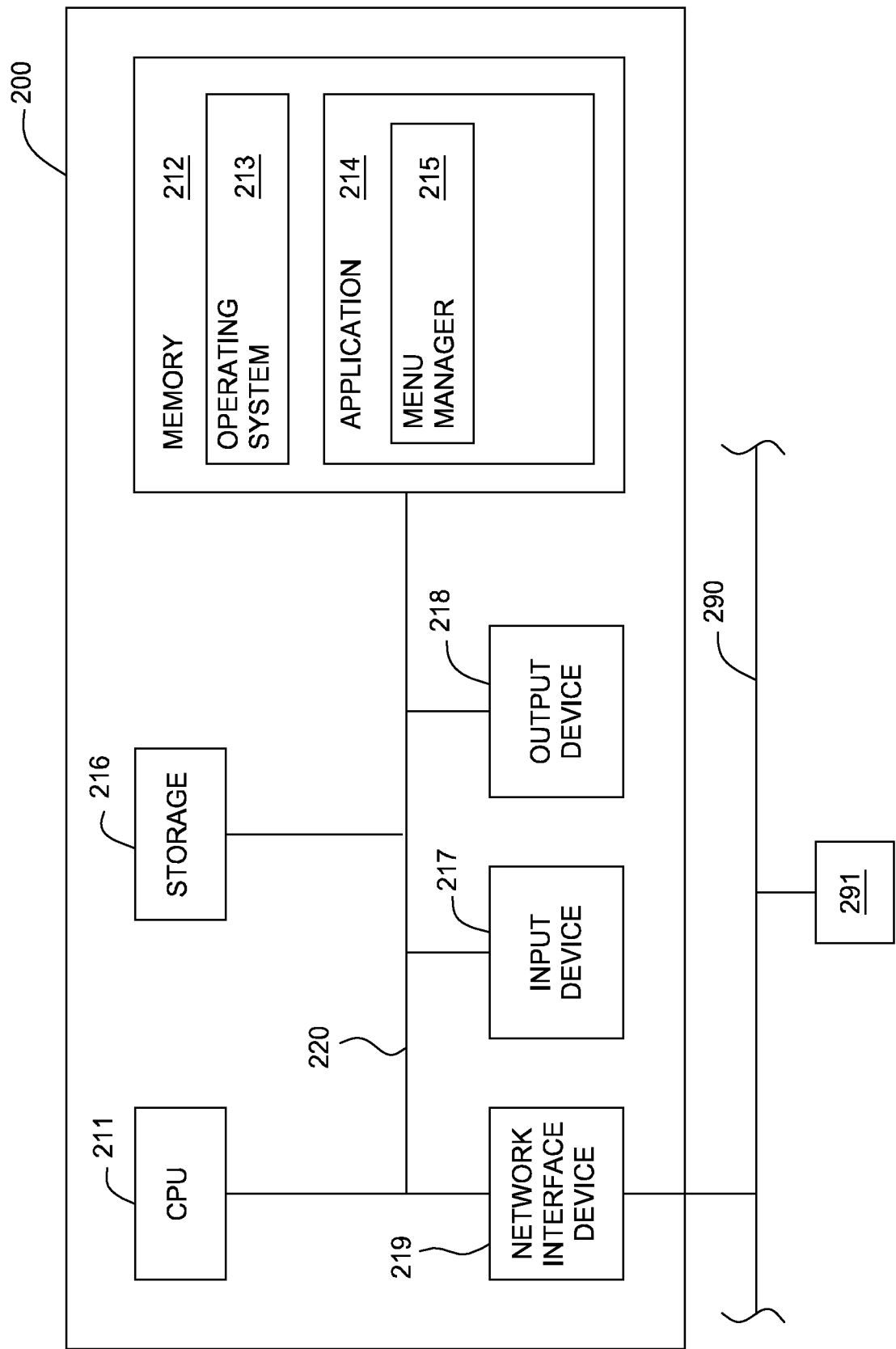


FIG. 2



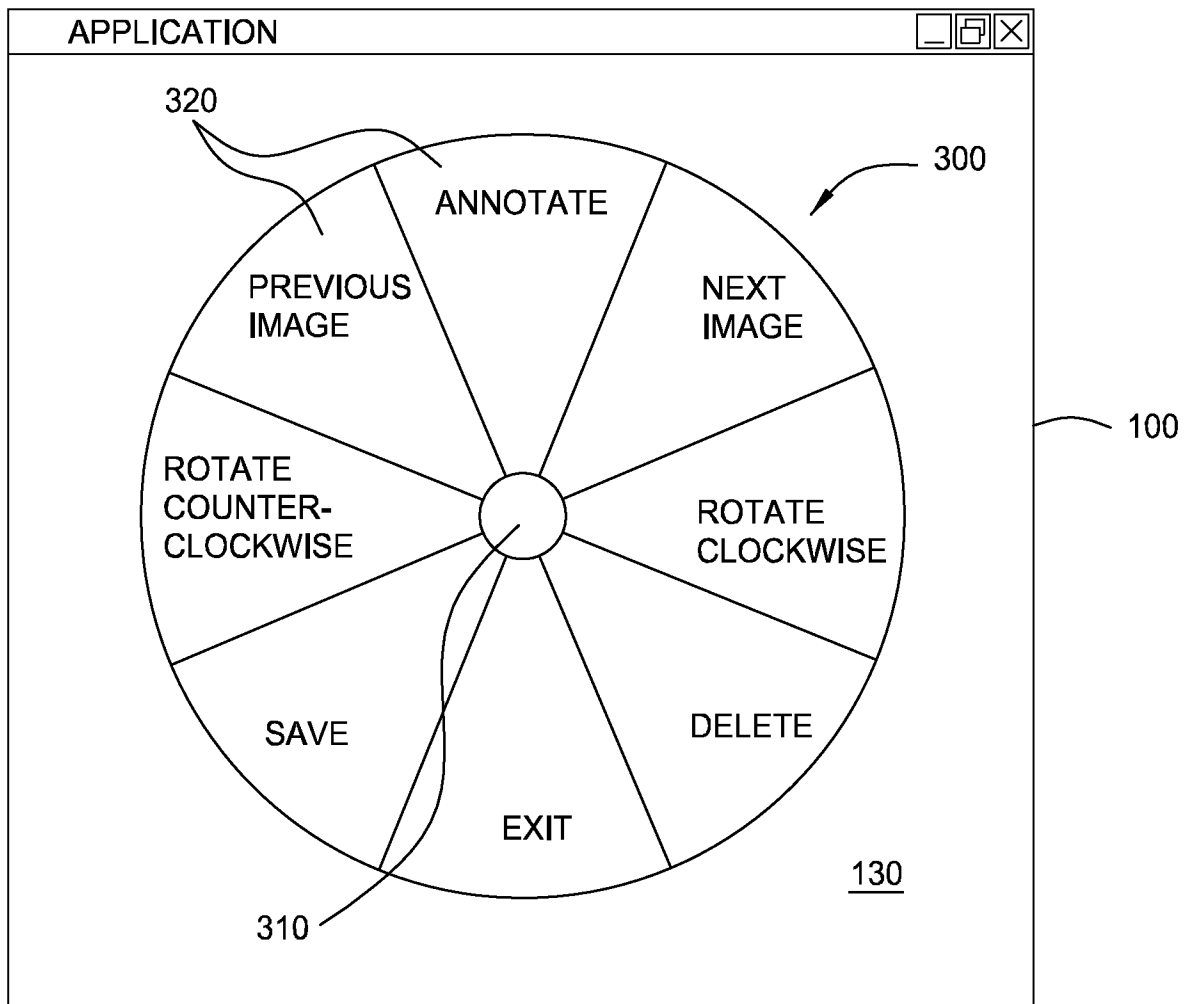


FIG. 3

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FIG. 4A

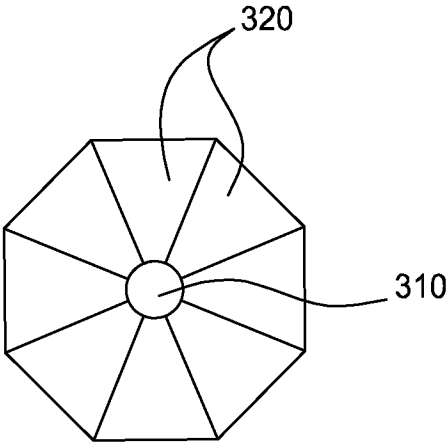


FIG. 4B

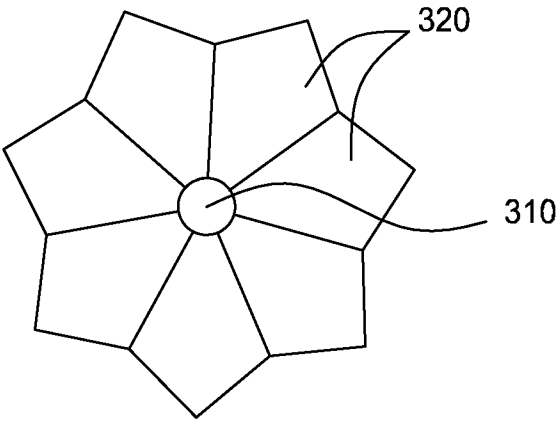
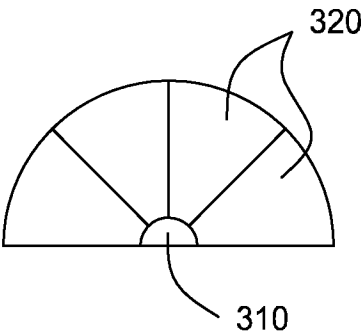


FIG. 4C



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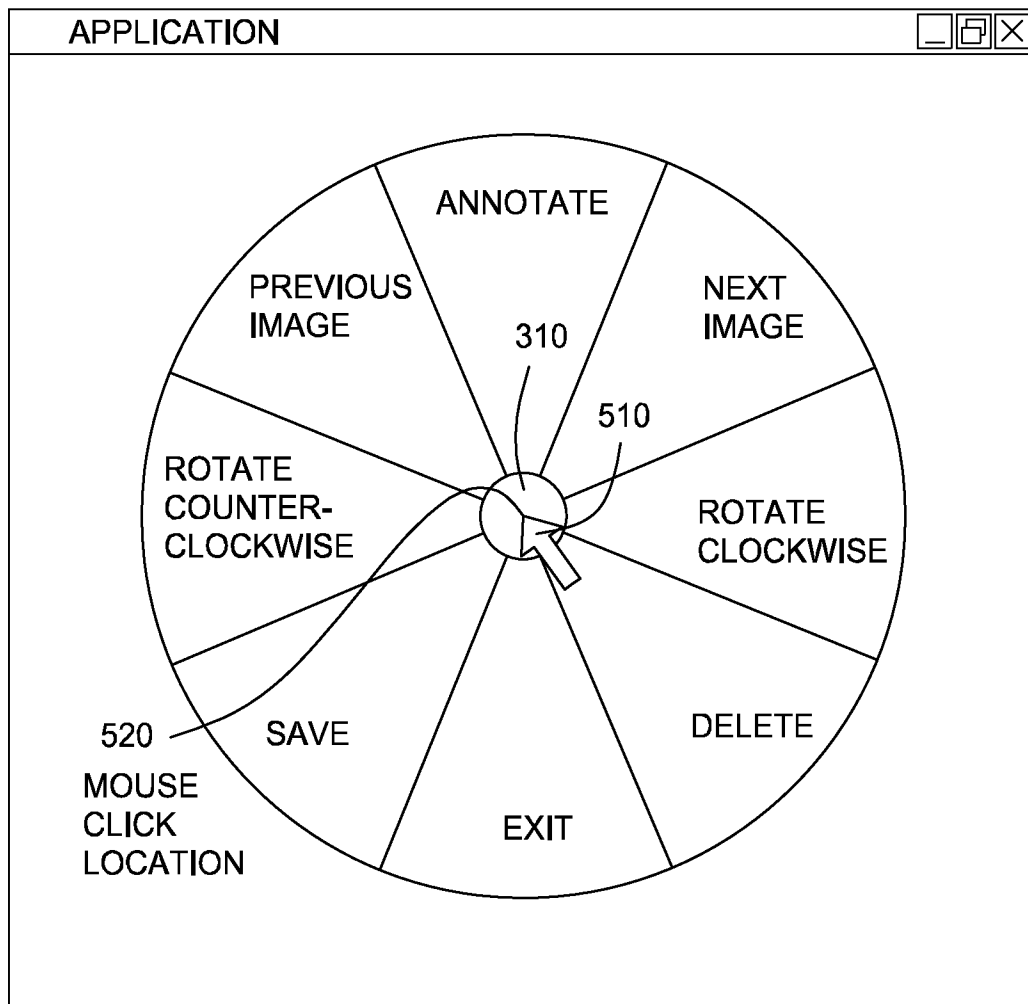


FIG. 5

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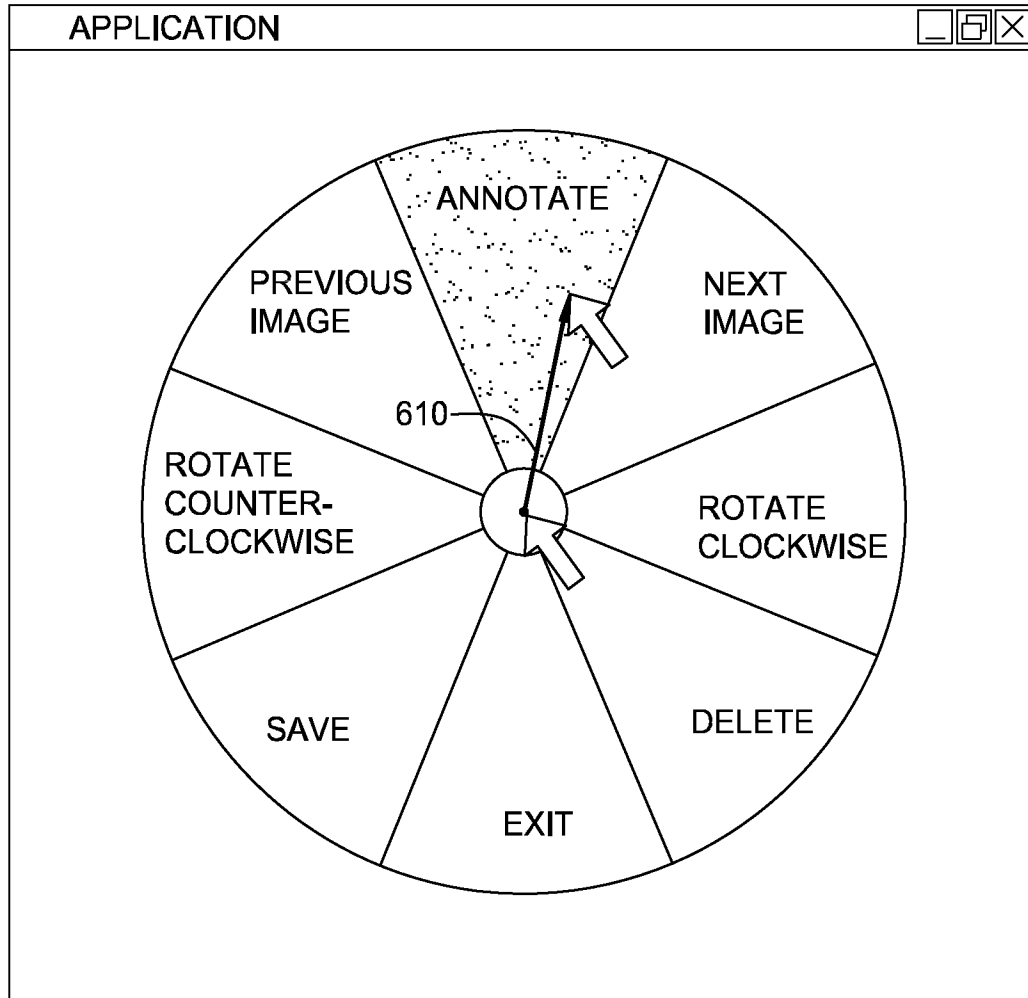


FIG. 6

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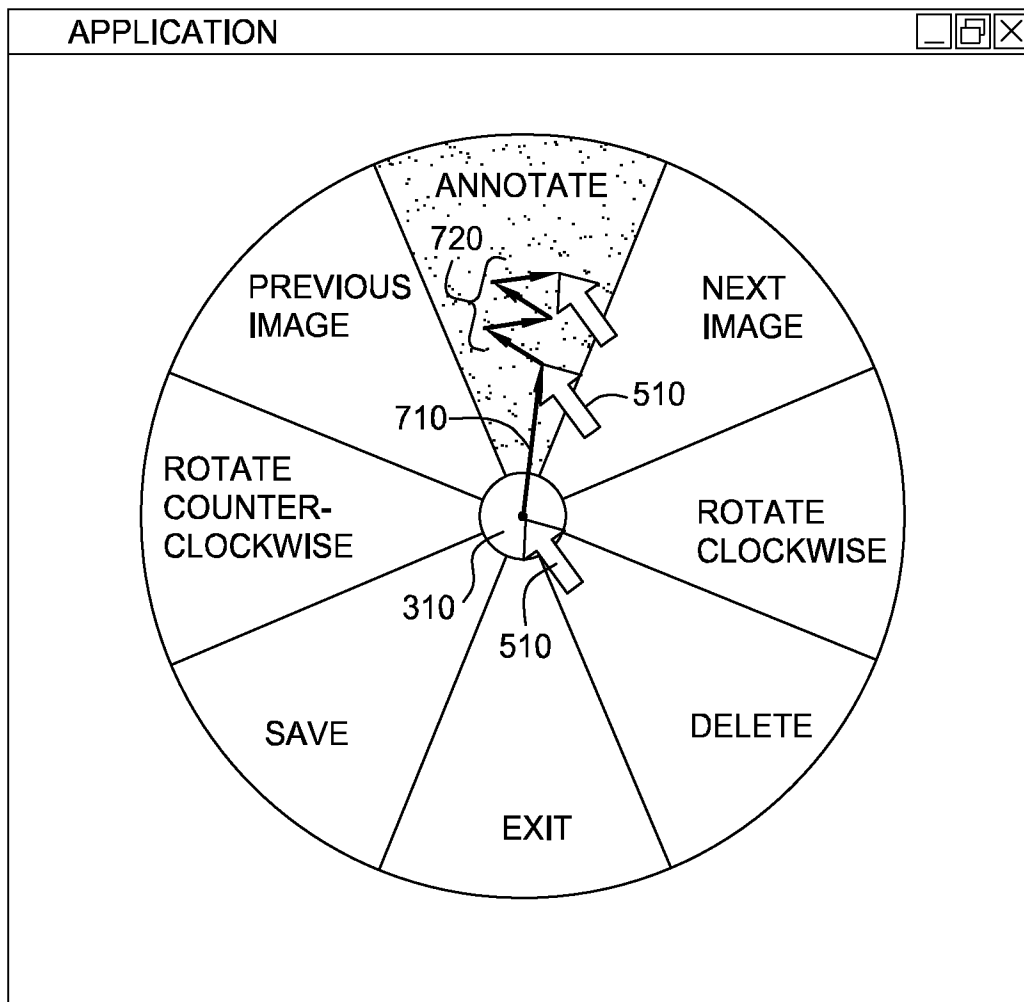


FIG. 7A

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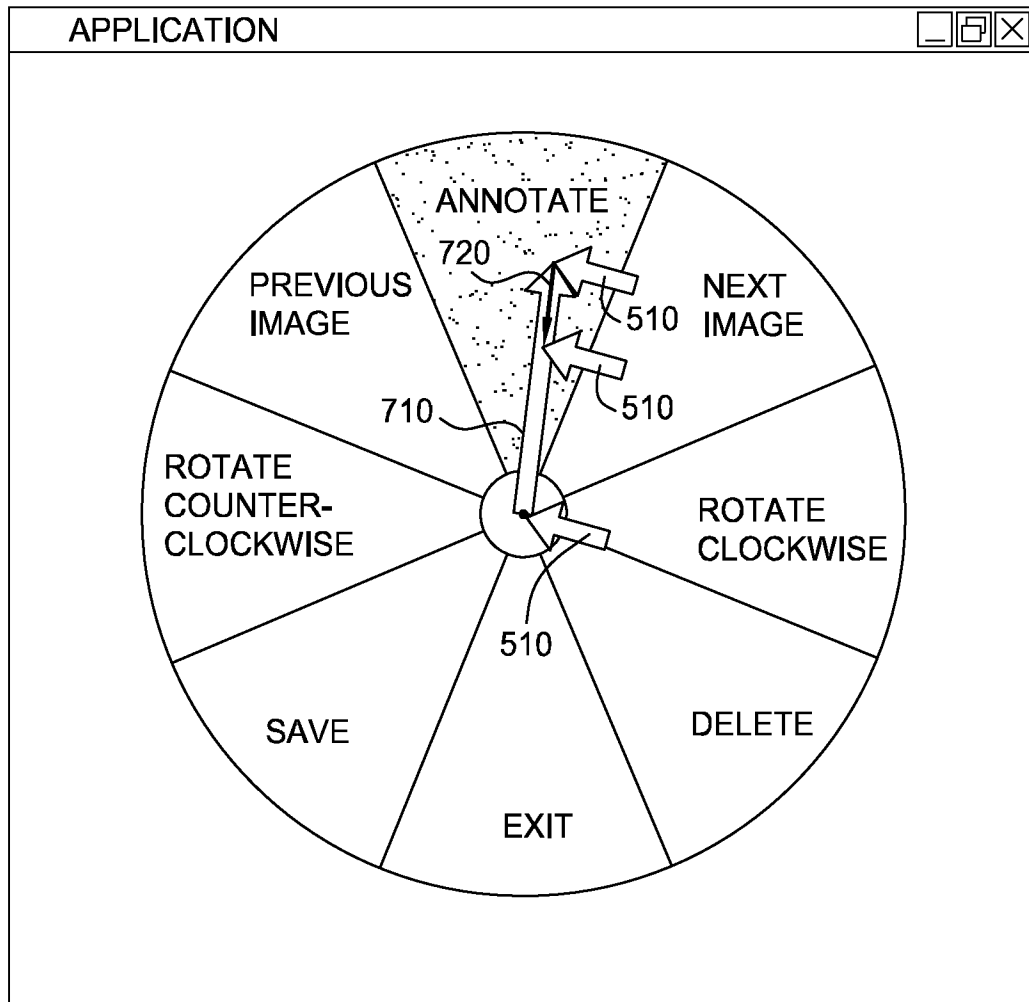


FIG. 7B

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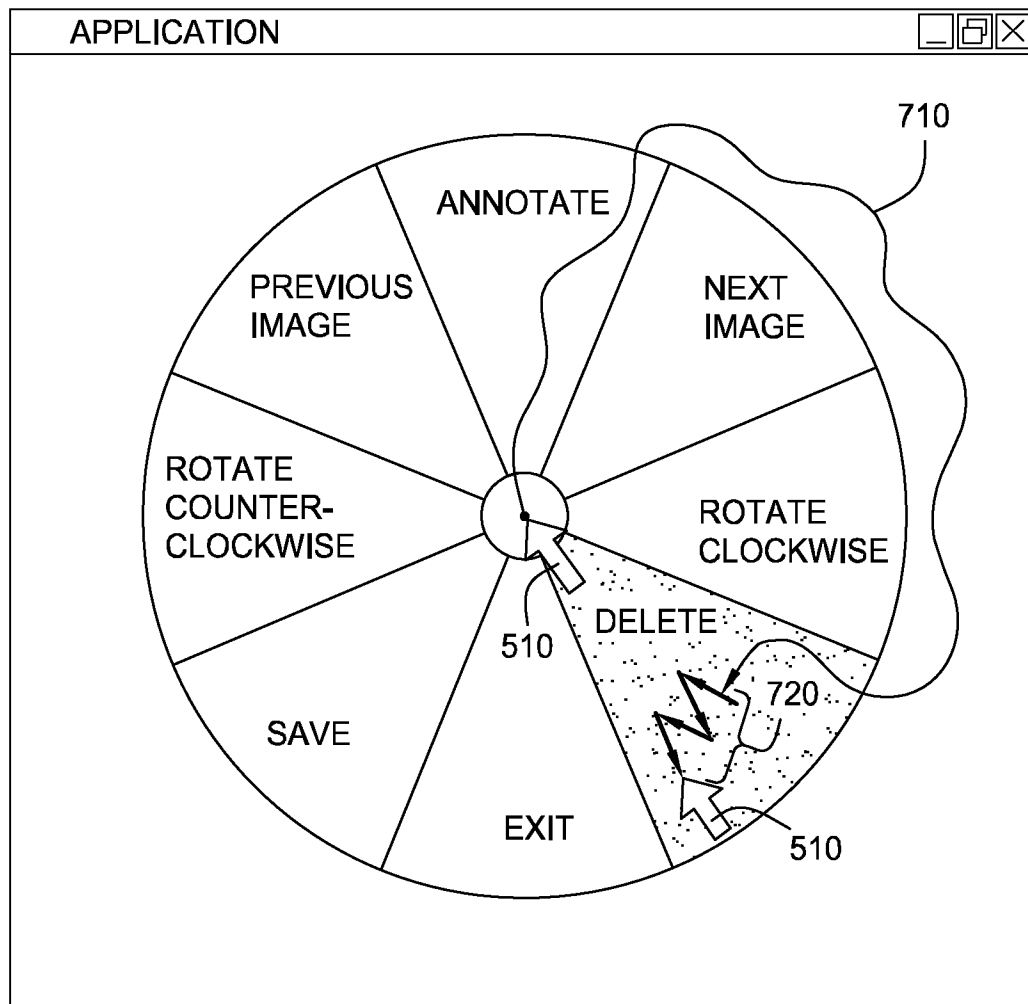


FIG. 7C

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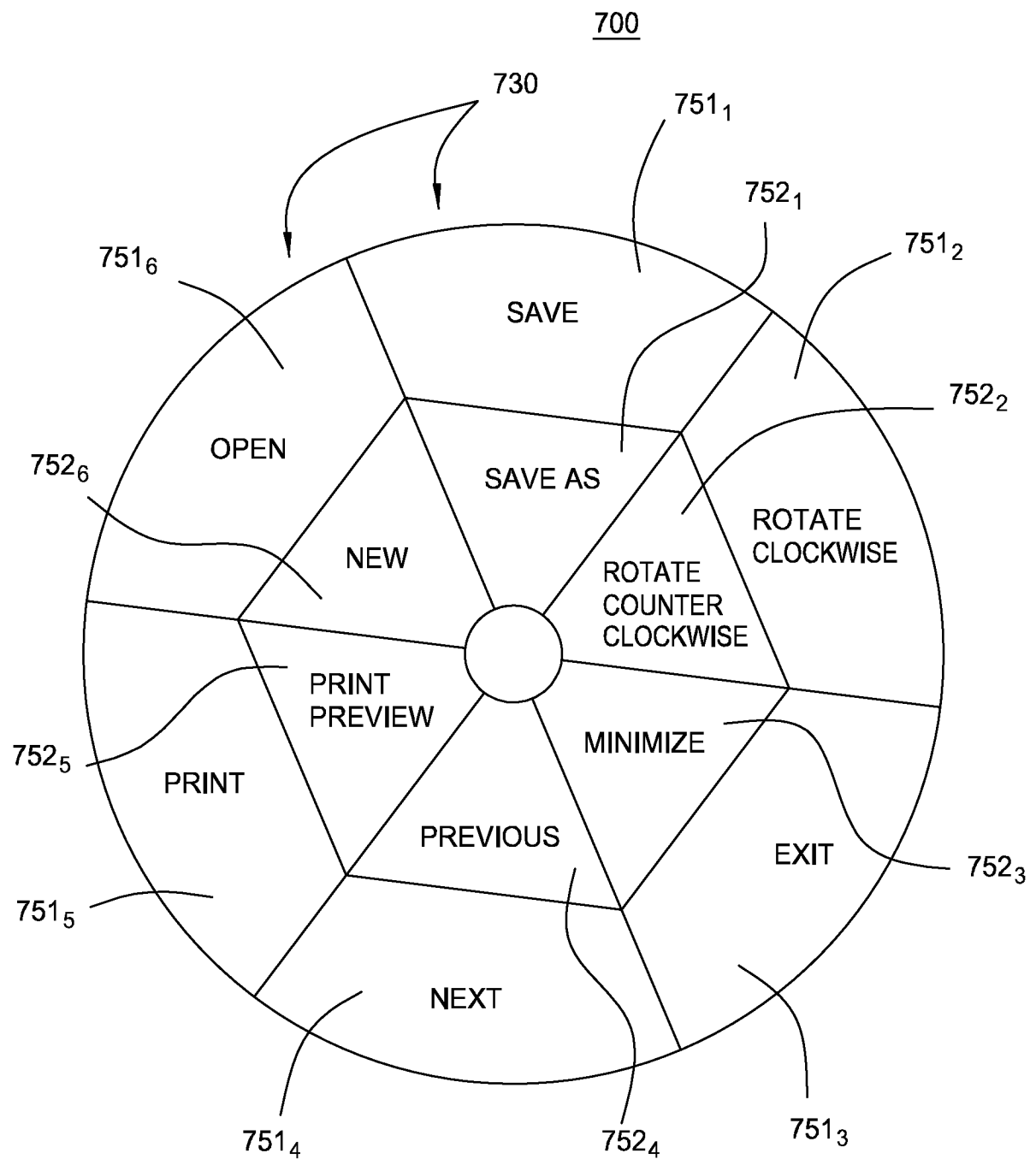


FIG. 7D



760



SCREEN POINTER MOVEMENT		MOUSE BUTTON INPUT		ACTION	
761	762	763	764	765	766
767	767	767	767	767	767
∅	▽	RIGHT BUTTON CLICK DOWN	▽	DISPLAY RADIAL MENU	▽
	▽	HOLD	▽	ACTIVATE RADIAL MENU ITEMS	▽
	▽	HOLD	▽	SELECT ACTIVATED RADIAL MENU ITEM	▽
∅	▽	RELEASE	▽	∅	▽

FIG. 7E

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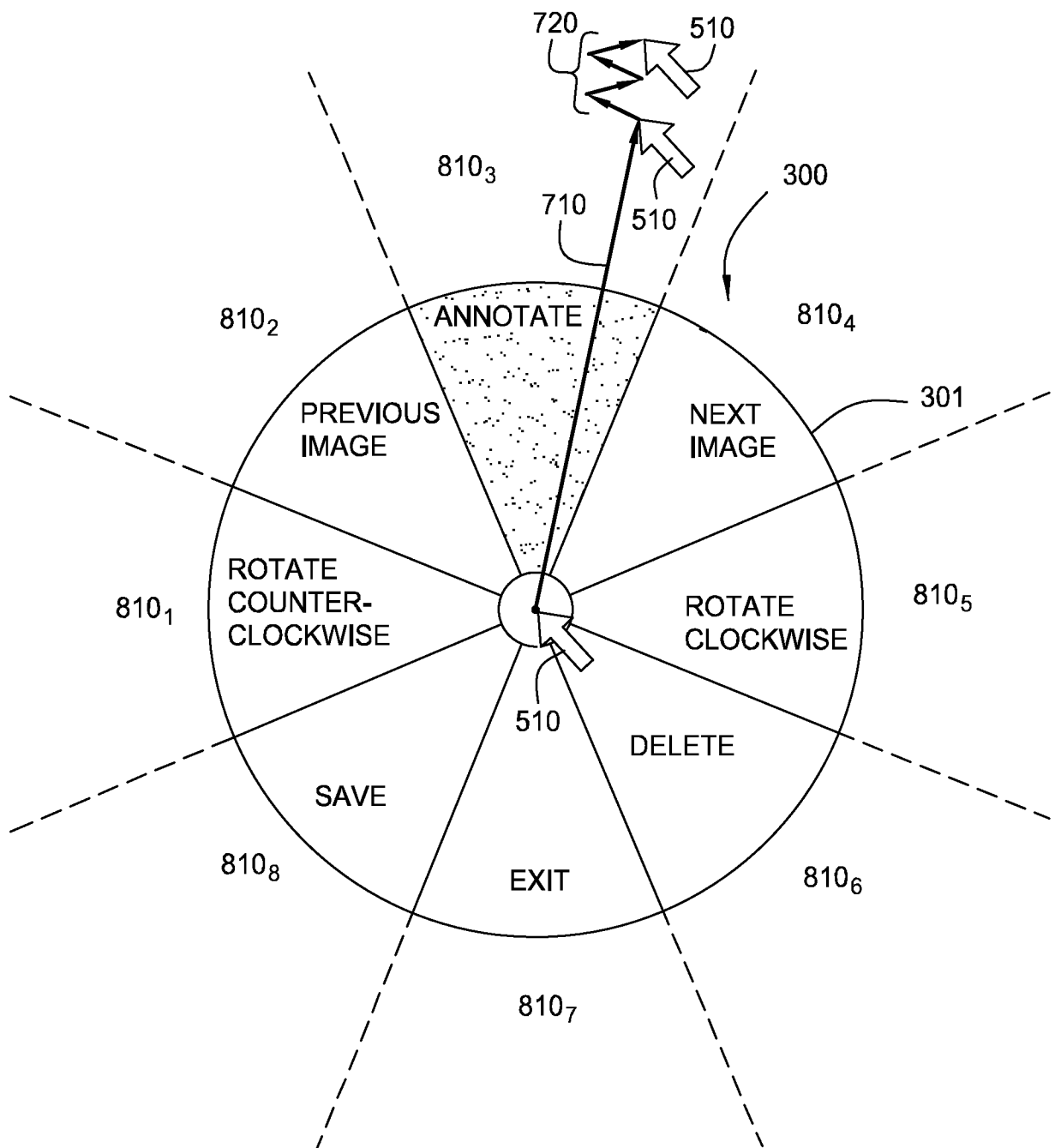


FIG. 8

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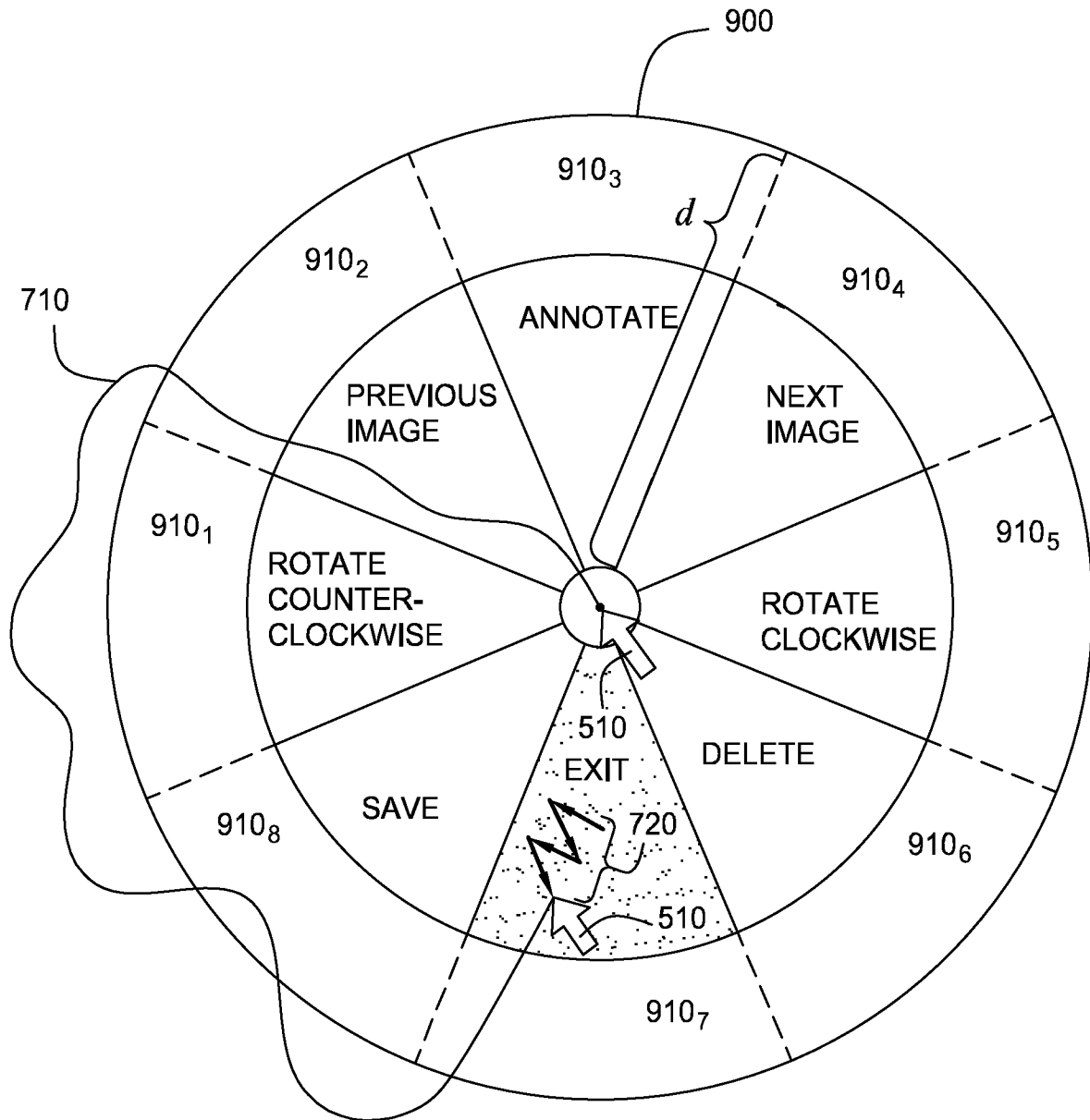


FIG. 9

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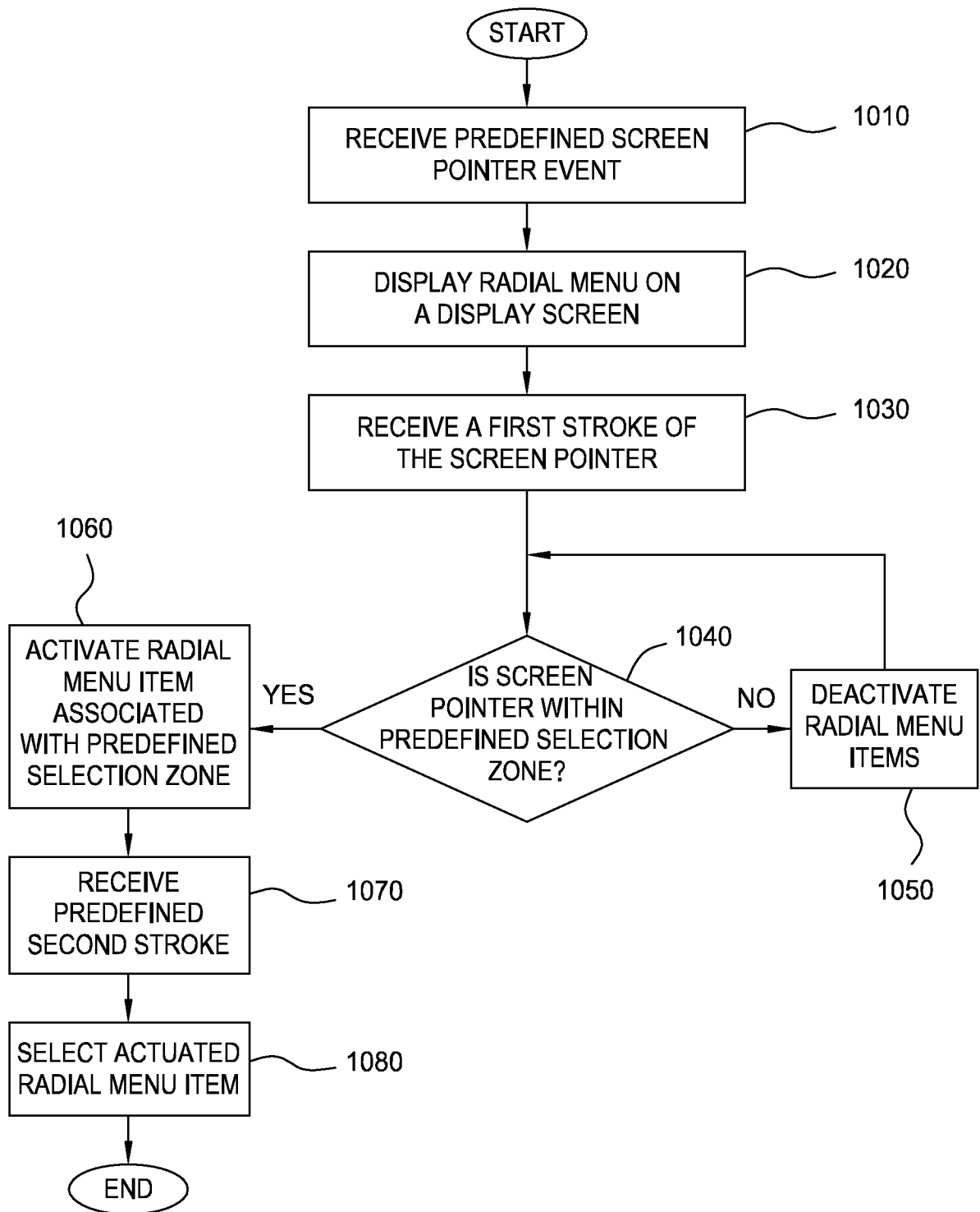


FIG. 10

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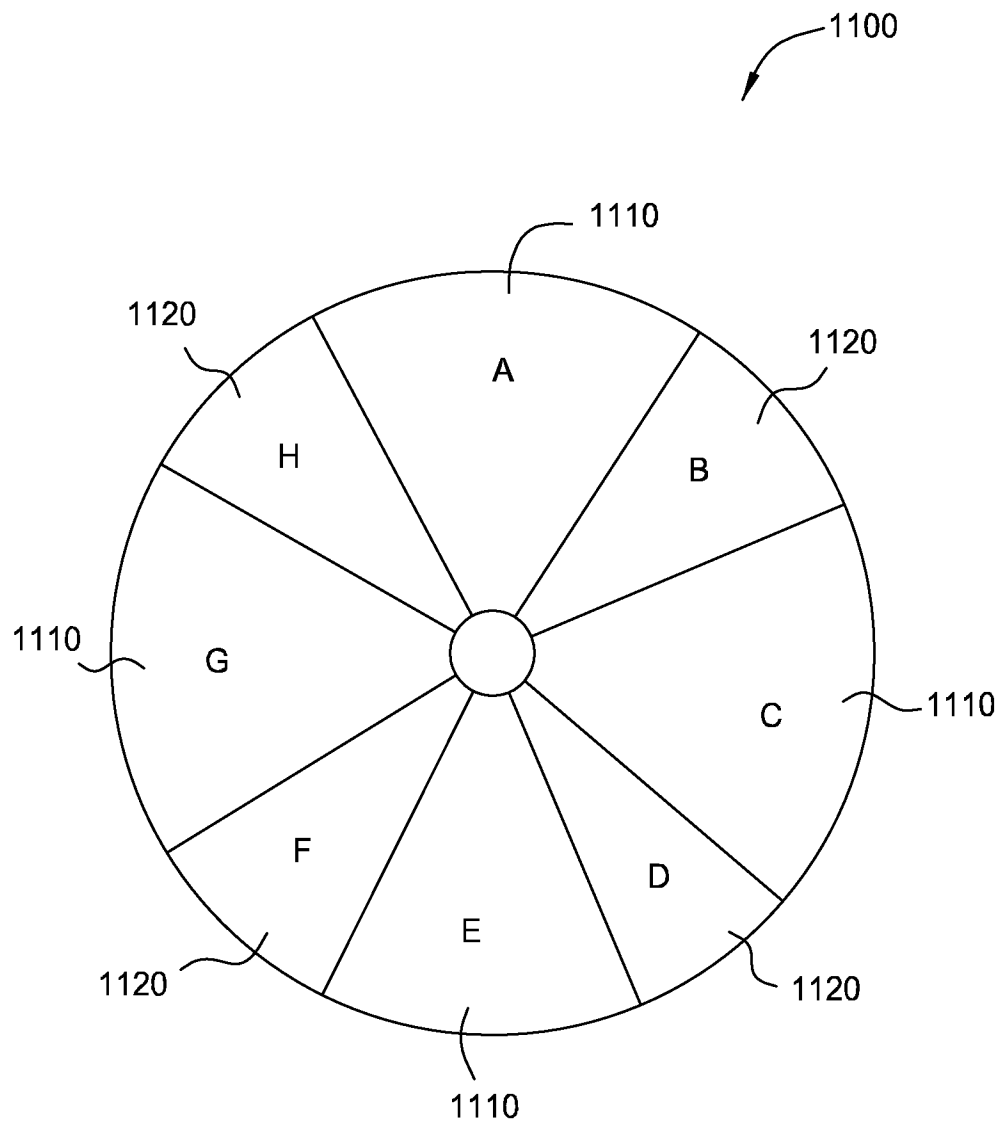


FIG. 11

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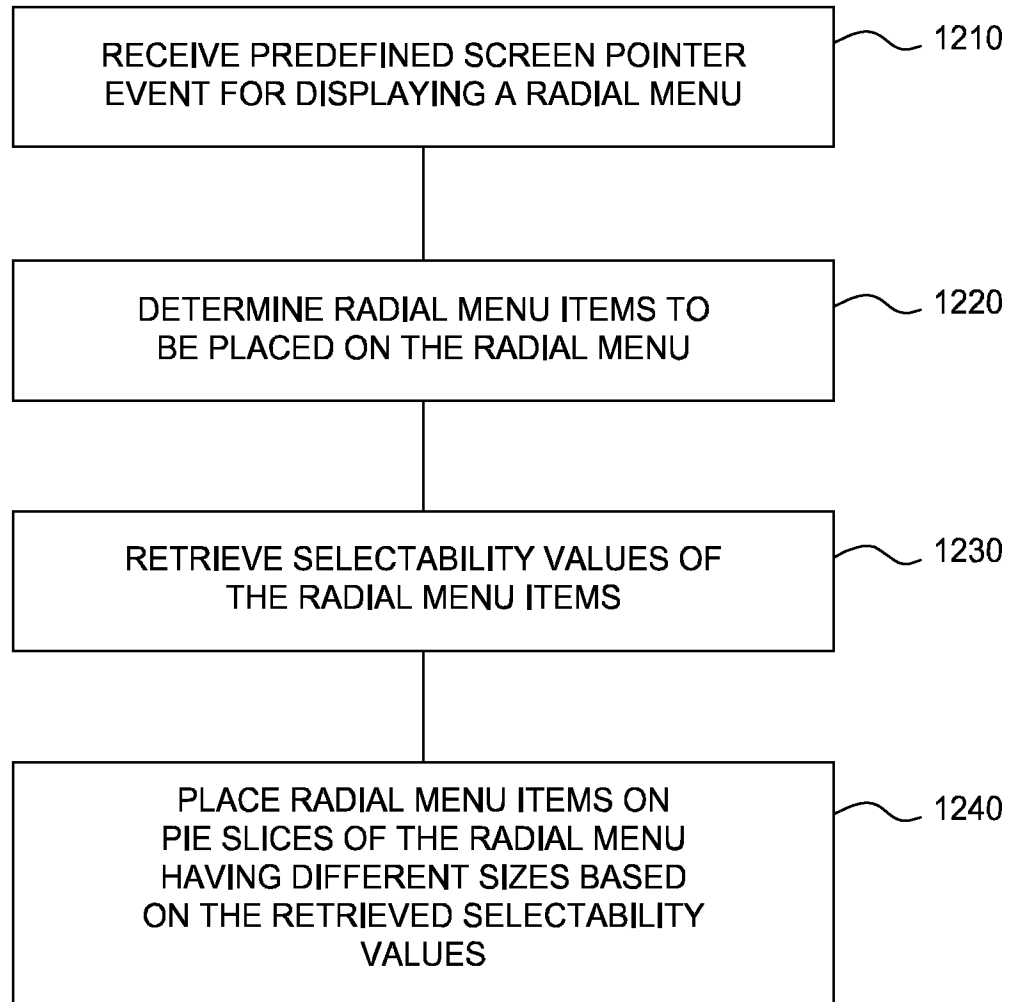


FIG. 12

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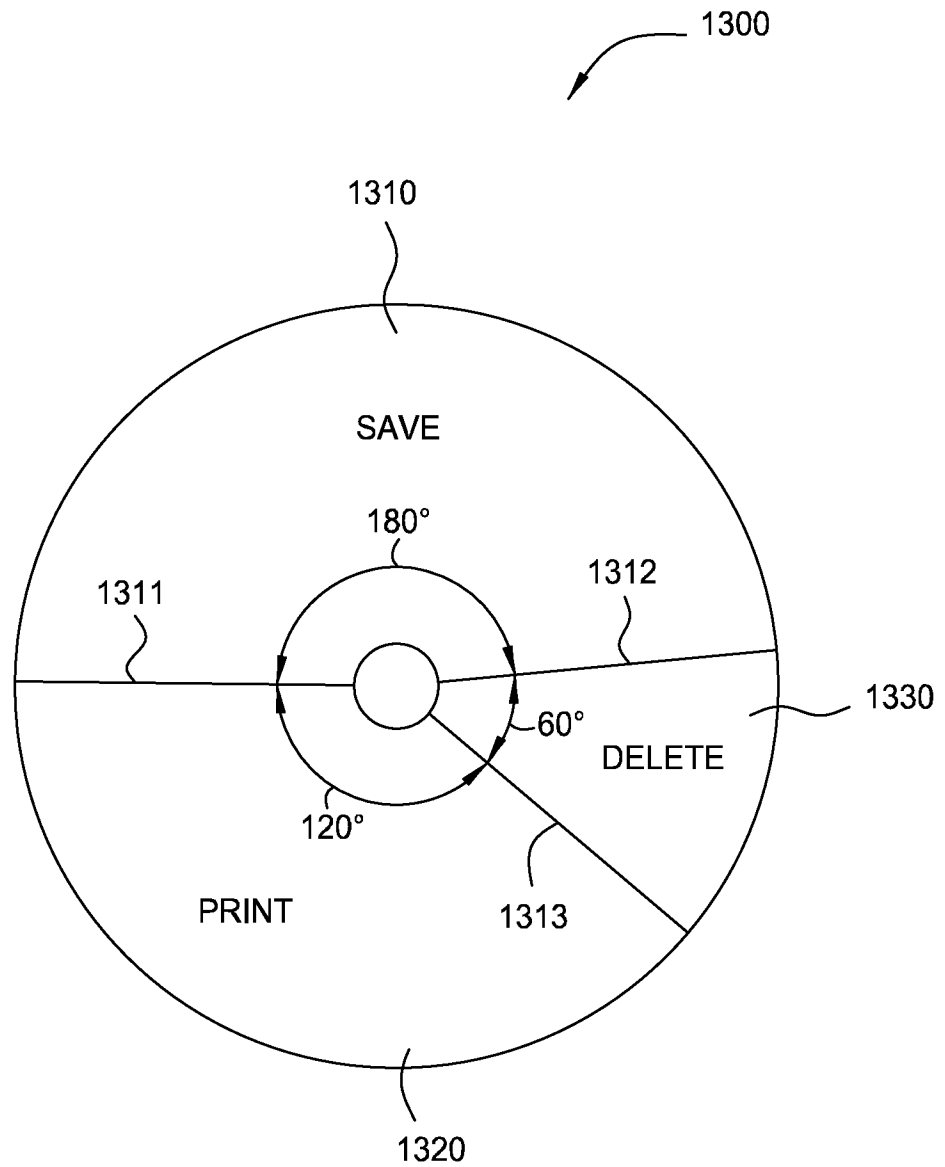


FIG. 13

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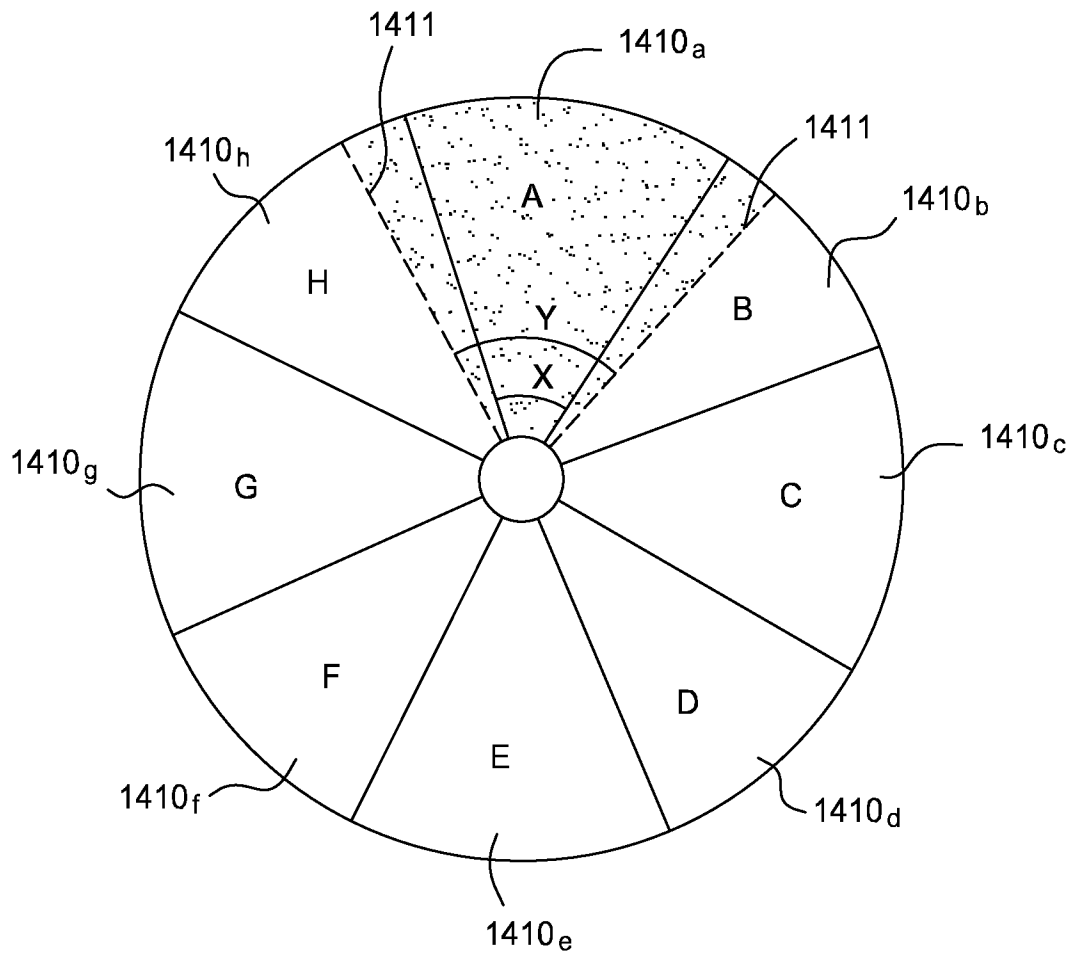


FIG. 14



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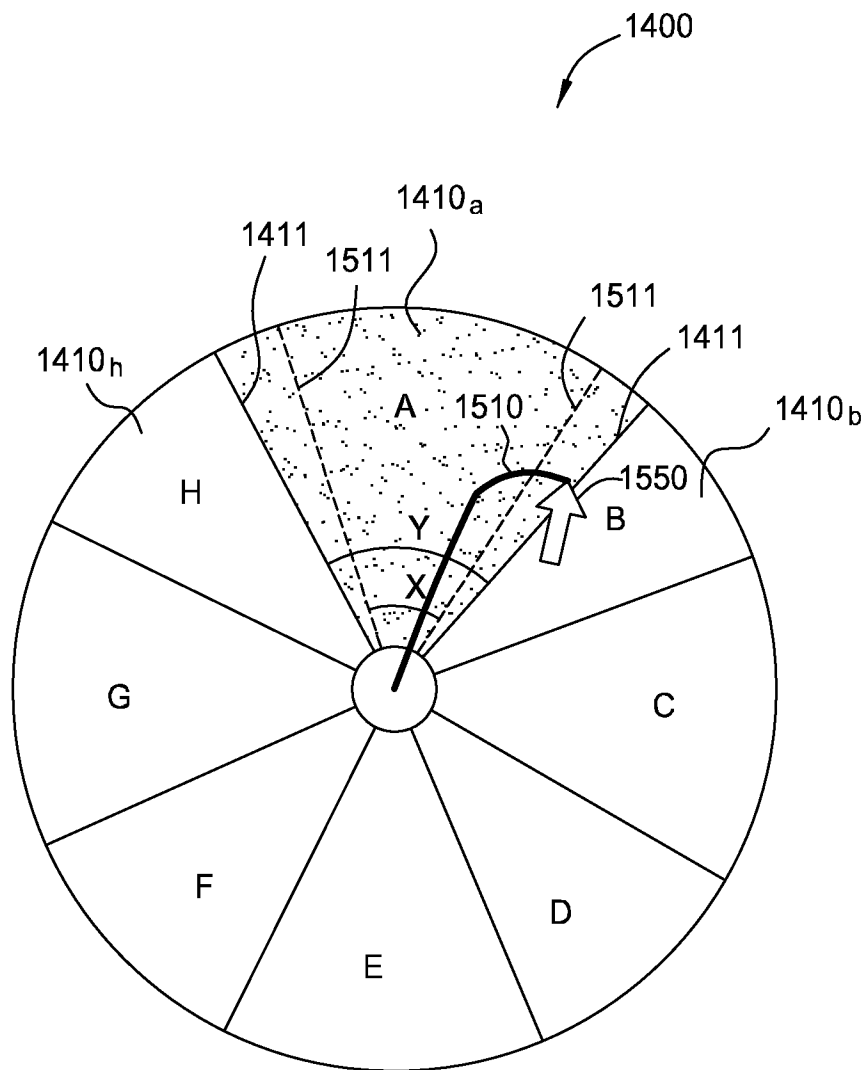


FIG. 15

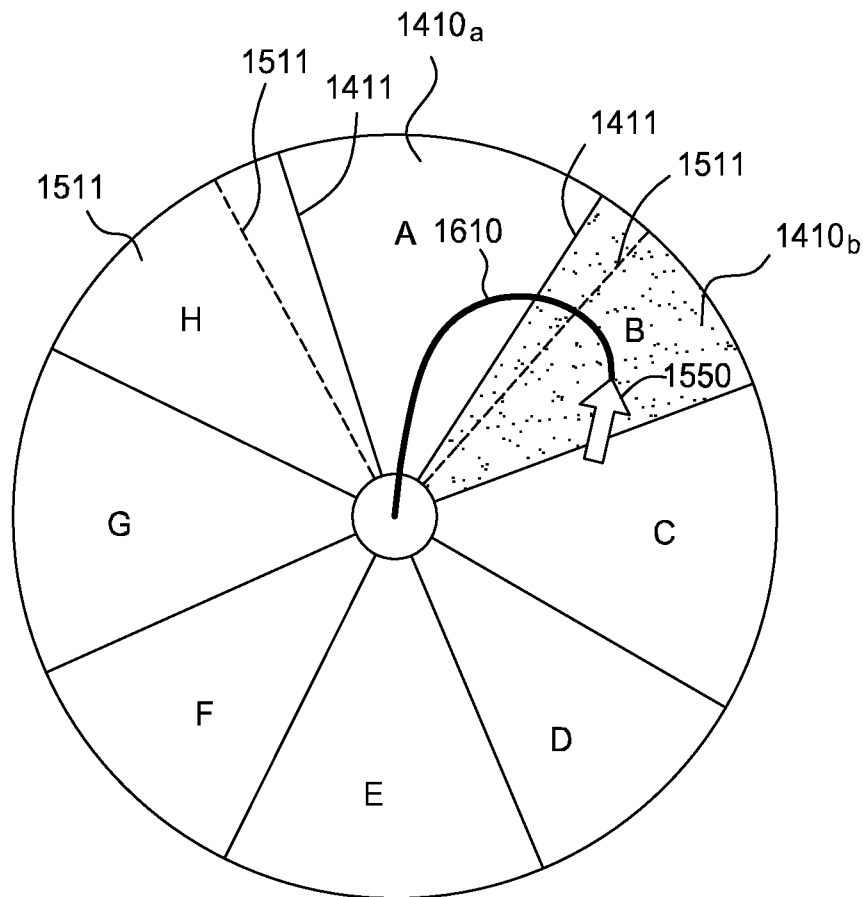


FIG. 16

# INTERNATIONAL SEARCH REPORT

International application No  
PCT/EP2010/056606

## A. CLASSIFICATION OF SUBJECT MATTER

INV. G06F3/048  
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

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, COMPENDEX

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 00/79375 A1 (LOGITECH INC [US]) 28 December 2000 (2000-12-28)	1-6, 9-15, 18-24,27
Y	* abstract page 10, line 14 - page 11, line 26 ----- -/--	7,8,16, 17,25,26

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

☒ See patent family annex.

\* Special categories of cited documents :

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"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

27 July 2010

Date of mailing of the international search report

10/08/2010

Name and mailing address of the ISA/

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Fax: (+31-70) 340-3016

Authorized officer

Schneider, Michael

## INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2010/056606

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>FITZMAURICE, G.; MATEJKA, J.; KHAN, A.; GLUECK, M.; KURTENBACH, G.: "PieCursor: merging pointing and command selection for rapid in-place tool switching"</p> <p>CHI '08: PROCEEDING OF THE TWENTY-SIXTH ANNUAL SIGCHI CONFERENCE ON HUMAN FACTORS IN COMPUTING SYSTEMS, FLORENCE, ITALY, [Online] April 2008 (2008-04), pages 1361-1370, XP002593794</p> <p>ACM New York, NY, USA DOI: <a href="http://doi.acm.org/10.1145/1357054.1357268">http://doi.acm.org/10.1145/1357054.1357268</a></p> <p>ISBN: 978-1-60558-011-1</p> <p>Retrieved from the Internet:</p> <p>URL: <a href="http://delivery.acm.org/10.1145/1360000/1357268/p1361-fitzmaurice.pdf?key1=1357268&amp;key2=8442510821&amp;coll=GUIDE&amp;dl=GUIDE&amp;CFID=98314959&amp;CFTOKEN=70334172">http://delivery.acm.org/10.1145/1360000/1357268/p1361-fitzmaurice.pdf?key1=1357268&amp;key2=8442510821&amp;coll=GUIDE&amp;dl=GUIDE&amp;CFID=98314959&amp;CFTOKEN=70334172</a></p> <p>[retrieved on 2010-07-26]</p>	1-6, 18-24, 27
Y	<p>* abstract</p> <p>page 1362, left-hand column, paragraph 2</p> <p>page 1362, right-hand column, paragraph 2</p> <p>page 1363, right-hand column, paragraph 3-9</p> <p>figure 4</p>	7, 8, 16, 17, 25, 26
Y	<p>US 2007/180392 A1 (RUSSO THOMAS P [US])</p> <p>2 August 2007 (2007-08-02)</p> <p>* abstract</p> <p>paragraphs [0031] - [0036], [0040];</p> <p>figure 3</p>	7, 8, 16, 17, 25, 26
Y	<p>US 2008/229245 A1 (ULERICH RHYS D [US] ET AL) 18 September 2008 (2008-09-18)</p> <p>* abstract</p> <p>paragraph [0025]; figure 7</p>	7, 8, 16, 17, 25, 26
Y	<p>US 2006/055662 A1 (RIMAS-RIBIKAUSKAS EMILY K [US] ET AL RIMAS-RIBIKAUSKAS EMILY K [US] ET) 16 March 2006 (2006-03-16)</p> <p>* abstract</p> <p>paragraphs [0054] - [0056]; figure 3</p>	7, 8, 16, 17, 25, 26
Y	<p>US 5 828 360 A (ANDERSON LISA C [NL] ET AL) 27 October 1998 (1998-10-27)</p> <p>* abstract</p> <p>figure 7b</p>	7, 8, 16, 17, 25, 26
Y	<p>US 2004/095395 A1 (KURTENBACH GORDON P [CA]) 20 May 2004 (2004-05-20)</p> <p>* abstract</p> <p>paragraphs [0034] - [0036]; figure 7</p> <p style="text-align: center;">-/--</p>	7, 8, 16, 17, 25, 26

## INTERNATIONAL SEARCH REPORT

International application No  
PCT/EP2010/056606

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

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2007/234224 A1 (LEAVITT JOSEPH M [US] ET AL) 4 October 2007 (2007-10-04) * abstract paragraphs [0189], [ 190]; figures 7a, 7b -----	7,8,16, 17,25,26
A	WO 2004/092906 A2 (AMERICA ONLINE INC [US]) 28 October 2004 (2004-10-28) * abstract page 10, line 23 - page 11, line 3 -----	1-27
A	EP 0 550 374 A2 (IBM [US]) 7 July 1993 (1993-07-07) figures 9,10 -----	1-27

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2010/056606

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
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