

A circular direct-selection interface for non-visual use

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Abstract

Disclosed is a user interface method that allows for quick, efficient exploration and usage of user interfaces by people who cannot see. The interface method is a circular direct-selection interface where many user interface elements are arranged around the edges of a touch panel or touch screen. This makes a circular list of elements that users can touch to get speech output and then activate when they find the desired element. This arrangement can be explored easily but also allows users to efficiently and directly select elements on familiar interfaces.

Keywords

Direct-selection, circular list, touchscreen, accessibility, blind, screen reader, text to speech, speed list loop, linear loop, circular direct-selection

Enabling Disclosure

Introduction to the problem

Using a touchscreen device is challenging for people with low and no vision because they cannot easily see any of the controls or other elements on the screen. Currently, two general categories of accessible interfaces for touchscreen devices have been developed to allow people to get speech output and activate elements: navigation and direct exploration/selection. With a *navigation interface*, a person must move or navigate through elements one at a time. The navigation paradigm is frequently used but is inherently inefficient because users must navigate past options they do not want until they finally get to an element with which they want to interact. The user often spends more time navigating than doing what he or she really wants to do with the interface. With *direct exploration and selection*, a person touches elements on the screen to hear them. When the desired element is found, it can be activated. One major problem with this method of activation is that a user has to search for elements by touch on a featureless screen. With an unfamiliar interface, users may have difficulty finding what they want. This difficulty is exacerbated with large screen sizes, with small elements, or with widely spaced elements.

The current invention, a *circular direct-selection mode*, is a method that allows for direct exploration and selection of an interface in a common, systematic pattern (Figure 1). It allows for more efficient use for both novel interfaces and interfaces with which people are familiar.



Figure 1. A visual depiction of the invention in use.

Description of system

The user interacts with a system, which is comprised of: a touch panel sensor, optional buttons or other user inputs, an optional display associated with the touch panel sensor (together forming a touchscreen), a microprocessor, memory, and a method for providing audio output (e.g., speakers, a headphone jack, or wireless audio connection). The system might take the form of a phone, tablet computer, or other device. A schematic diagram of the system is shown in Figure 2.

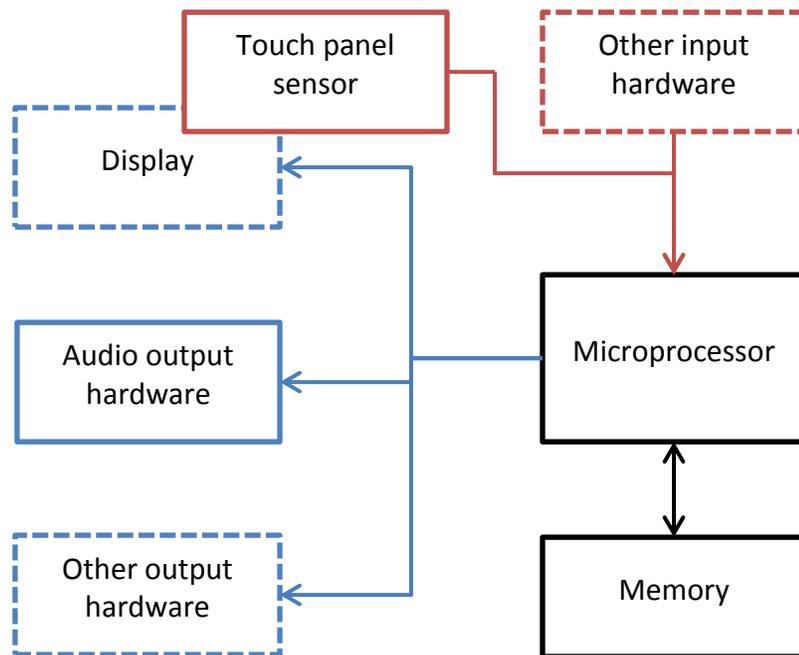


Figure 2. A diagram of the system. For input, the system has a touch panel sensor and other optional input hardware. The touch panel sensor may directly overlay an optional display forming a touchscreen. For output, the system has at least audio output hardware and may have an optional display (visual or tactile, such as dynamic braille). The input and output components are connected to a microprocessor, which runs software that may be loaded into memory.

The *circular direct-selection mode*, which enables the user to easily find and quickly activate components of a user interface, is implemented in software that runs on the system.

Description of the circular direct-selection mode

In this invention, most user interface elements (such as buttons, checkboxes, text input fields, and text) are touch panel areas that are arranged along the edges of the touch panel sensor (which might be a touchscreen). In effect, this makes all of the elements into a **circular list** around the touch panel. Users can follow the edges of the touch panel with a finger and get to all of the elements in the circular list. This consistent pattern makes it easy for users to search for elements without having to try a variety of search patterns and techniques like they might have to with a typical system that allows for direct exploration and selection. See Figure 3 for a generic representation of the circular direct-selection mode on a touchscreen of a mobile device.

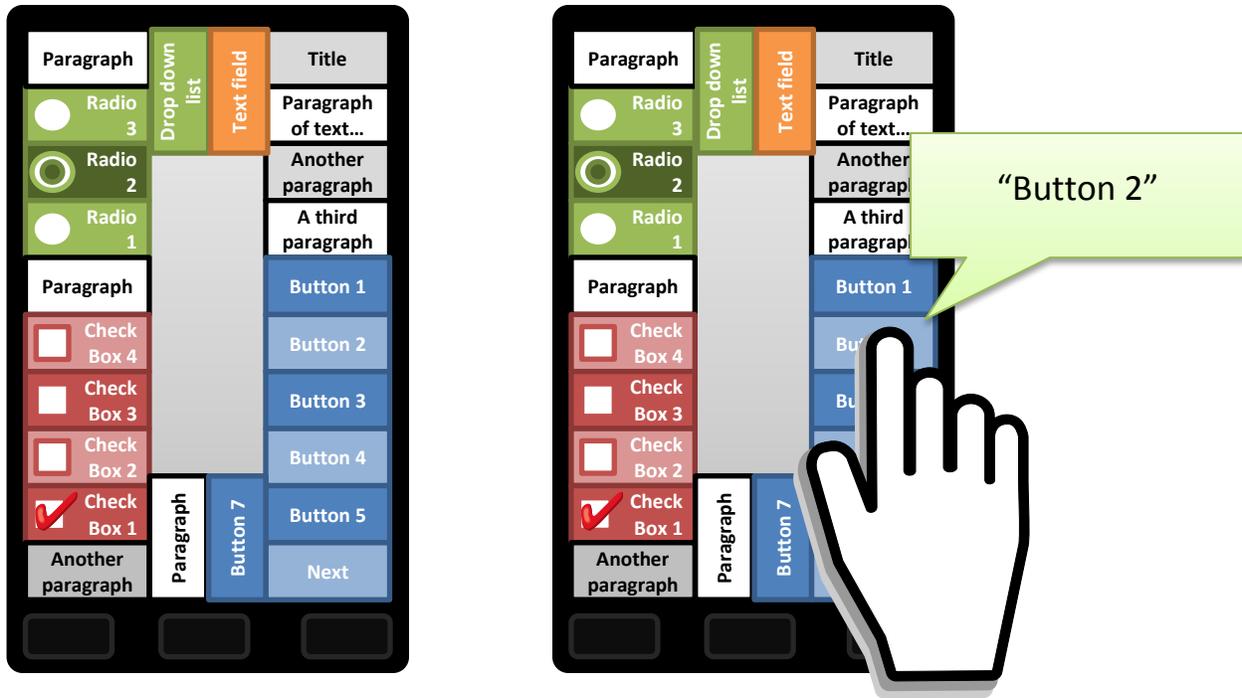


Figure 3. A representation of a circular direct-selection interface on a mobile touchscreen device. On the left, all of the (generic) elements of the interface are arranged in a circular list around the edges of the screen. When the user touches an element (right), the label or other information about the element is provided to the user in speech output.

Exploring an interface: With encountering a novel interface, it is envisioned that a user will slide or drag his or her finger around the edge of the touch panel and listen to the speech output. When the user’s finger is on the area that represents a particular element, information about that element will be provided in speech. For users with low vision, the element information might be displayed on a screen in large text. For users who read braille, the element information might be provided on a dynamic braille display.

Activating a user interface element: When the user finds the element he or she wants, the user makes an action to activate or otherwise manipulate that element. For example, the user can activate a button, toggle a checkmark in a checkbox, or increment a numeric value. The action that a user takes to activate or manipulate an element may vary depending upon the system capabilities and the element that is focused or under the user’s finger. For example, the user might:

- Press a separate physical button such as an Enter key
- Speak a command
- Tap the onscreen element again
- Tap a dedicated area of the screen
- Double-tap anywhere on the screen
- Press harder on the onscreen element with pressure sensing touchscreens
- Make a swipe up or swipe down gesture to increment or decrement a numeric value
- Make some other gesture on the touchscreen

The activating/manipulating user action may take place while the user's finger is in contact with the desired element. Alternatively and preferably, the user may lift his or her finger leaving the last-touched element in focus. The element in focus could then be activated with a subsequent user action.

Using a familiar interface: With continued use of the circular direct-selection mode, a user may learn the general location of controls of interest in the circular list for a particular interface. When the user is familiar with an interface, the user can directly point to the control in the circular list, confirm through the speech output (or other output) the desired element, and then activate the desired the element. This direct selection technique is faster than exploring the interface by touch or navigating it with keystrokes or gestures.

When there are too many elements to fit on one screen: For pages with a relatively small number of elements, all elements can fit in the circular list on a single "screen." When there are more elements in the interface than can fit in one circular list, the user must be able get to the overflow elements. Two solutions are proposed for this problem:

- The last element in a circular list that overflows might be a "Next Screen" or "Page Down" button. The user could then activate that button to move to a next screen which contains additional elements in the circular list that did not fit on the earlier circular list screen. A "Previous Screen" button could be provided to go back to previous circular lists.
- A user might make or continue a sliding or dragging gesture across the boundary between the last and first item of the circular list. With this gesture, the system would automatically change to the next group of circular list items. A gesture in the reverse direction would go to a previous group of circular list items. This gesture has the benefit of being like that of a jog wheel. By convention, turning a jog wheel clockwise goes to later elements, and turning it counterclockwise goes to earlier elements. With each circumnavigation of the touch panel, a user would be presented with a new screen-worth of interface elements until they have explored the entire interface.

Potential additional circular direct-selection interface features

It is envisioned (but not required) that the circular list would start in the upper right corner of the screen and continue clockwise around the screen. This arrangement has the following potential benefits:

- If there are few elements in an interface, they would all fit along the long edge of a smartphone screen held in portrait orientation.
- To progress through more elements, the user would slide their finger clockwise. This clockwise motion is a familiar gesture/direction from using jog wheels for navigation.

Ensuring the user knows when they have reached the end of an interface: It is helpful for many users to know when they have reached the first or last elements in a list. The beginning and end of the list, which might be on different "screens" because of overflow, might have extra elements: one denoting the top of the list and the other denoting the bottom of the list.

Dedicated controls: The operating system and many apps may have a set of common or global controls to which it might be useful for the user to have easy, quick access. Dedicated controls might include a Cancel or Back function, navigation controls, an activation button, a “Where am I?” button to allow people to get an overview of the current page, speech output settings menu, etc. Dedicated controls could be placed in a consistent location on the screen and might be user configurable. The circular list of items might be “interrupted” by these controls in dedicated locations. Three beneficial arrangements have been identified (which are not mutually exclusive):

- *Corners:* The dedicated controls could be placed at the corners of the screen. These locations are easy to find tactilely. The dedicated control in each corner would interrupt the circular list.
- *Along a short edge:* The dedicated controls might also be placed along the short edge of the screen (for example the top of a smart phone). With a limited number of dedicated controls, their position would be easy enough to find without sight. By having the dedicated controls at the top (where the starting point is the top right corner), they would only interrupt the circular list at the end of each screen-worth of elements.
- *In the middle of the screen:* A limited number of dedicated controls may be placed in the middle of the screen—not in the loop of general interface elements.

See Figure 3 for a representation of the first two dedicated control locations.



Figure 4. Dedicated controls in this figure are yellow and are labelled: “Where am I?”, “Back”, “Next”, and “Prev.” The figure on the left shows the dedicated controls in the corners. Notice that they interrupt the circular flow of the circular list of elements. The figure on the right shows the dedicated controls all at the top of the screen.

Hysteresis: It can be difficult to use a touchscreen without sight because a person does not know where edges of controls are. Button hysteresis is a technique that effectively makes the currently touched control bigger. When on an element, the user must drag slightly further

outside of the current element to move to a new element. Once in the new element, it is then effectively larger, so the user would have to drag slightly further outside the new element to get back to the previous element. This prevents the focus/speech from moving quickly back and forth between elements if the user was touching exactly on the border and had a slight tremor.

Element resizing: Depending upon the number of elements in the circular list, the elements might resize. When there are fewer elements, each element might be bigger to allow for more accurate targeting. This is envisioned to be a user-specific setting. In implementations, there is likely an upper limit to the size of elements so that users do not have to drag “too far.”

Flexibility: The circular list arrangement of controls might be one arrangement of controls from which users can select. It does not preclude a different interface arrangement with which a user may already be familiar. For example, a person might use the circular list for most interfaces, but switch to a standard onscreen QWERTY keyboard with which they have a lot of experience when they need to enter text. Note also that the circular list arrangement does not preclude navigating an interface if a user would rather do that. For example, to navigate, a user might press dedicated controls or make swiping gestures across the screen (or in the middle where the circular list is not located).

Advantages of the invention

Navigation interfaces require a person to step through elements to find the one they want. This might be done with navigation buttons, gestures, or a jog wheel. Some of these methods require many motions and may be fatiguing. Other methods may require less motion, but still require a person to potentially navigate through a long list of elements that the person does not wish to choose at this time. Where users may use an interface often enough to learn the position of elements on screens, this invention is superior to using navigation controls to move through the list of elements. The user can directly point to the location of the desired element, which is faster than navigation.

With a direct exploration and selection interface, a person touches elements on the screen to hear them. This potentially allows for quicker access than navigation, but introduces a new problem: the user with little or no vision does not know where elements are located on the screen. The user must search a featureless surface with a finger and audio and might pass by or miss the element they desire. The spatial re-arrangement of elements into a circular list with the current invention allows for a consistent search and exploration strategy that guarantees that a user will not miss an element if they cover the entire circular list.

Note that the Trace Research & Development Center at the University of Wisconsin-Madison developed a technique called Speed List in the 1990s, which has some similarities to the current invention. Some of the claims and descriptions of U.S. patent number 6,049,328 concerns this Speed List mode. When Speed List mode was activated, all of the elements on the screen were arranged from top to bottom along the left edge. Users could slide their finger down the left edge of the screen to get audio output as they touched each element. They would then press a physical button to activate the desired element. The number of elements in the list was limited by the number of elements that could be placed along the left edge of the screen. This was a reasonable limitation for kiosk systems but is unacceptable for personal devices and interfaces.

The circular list of elements described in this invention allows for overflow onto additional “screens,” which circumvents the Speed List limitations.

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