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Haptic Touchscreen

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ABSTRACT

Screen readers assist the visually impaired by describing the contents of a screen. However, dynamic content and non-standardized layouts are difficult to describe. This disclosure leverages haptic technology and tactile simulation to enable users to feel the content of a screen with their fingers. Window borders, tabs, scroll bars, banner ads, clickable user interface elements, text, images, etc. become accessible to the user not only visually but also via touch. The haptic touchscreen creates an immersive experience for both visually impaired users and users with normal vision. Code and content development for both classes of users is streamlined. In terms of content layout and ease of interactivity, visually impaired users can have a computing experience analogous to the experience of users with normal vision.

KEYWORDS

- Accessibility
- Haptic touchscreen
- Braille display
- Simulated texture
- Tactile simulation
- Refreshable braille

BACKGROUND

Screen readers assist the visually impaired by describing the contents displayed on a screen. However, dynamic content and non-standardized layouts are difficult to describe. Conventional screen readers, which typically only read out text or verbally describe images, significantly hinder the immersion and workflow of the user.

Some screen reading or magnification solutions provide first-party apps for word processing, email, internet access, etc. as substitutes for popular third-party apps. These have steep learning curves. Further, many screen reading applications can only read text, as opposed to providing the user with an interactive description of screen content.

Refreshable braille displays are expensive hardware peripherals that can be more cumbersome for development and usage than an audio screen reader. Some of these problems can be partially alleviated by foresight and by additional work performed by content developers (e.g., providing alt-text for images, screen reader compatible user interface design, etc.), but this imposes additional costs and may not always be a developer priority.

DESCRIPTION

This disclosure leverages haptic technology and tactile simulation to enable users to feel the content of a screen with their fingers. Window borders, tabs, scroll bars, banner ads, clickable user interface elements, text, images, etc. become accessible to the user not only visually but also through touch.

Fig. 1(a) illustrates a conventional touchscreen, and Fig. 1(b) illustrates an example haptic touchscreen. Text (102a) can be on-the-fly translated to braille (102b) in the same screen location as the text. Images can be converted to grayscale and represented topographically (104a-b). Window borders (106), tabs (108), buttons (110), navigation or other clickable widgets (112), scroll bars (114), etc. can be represented with different haptic tones, textures, or bumps. The described haptic touchscreen can have touch and force-sending capability, such that it functions as a touchpad as well.

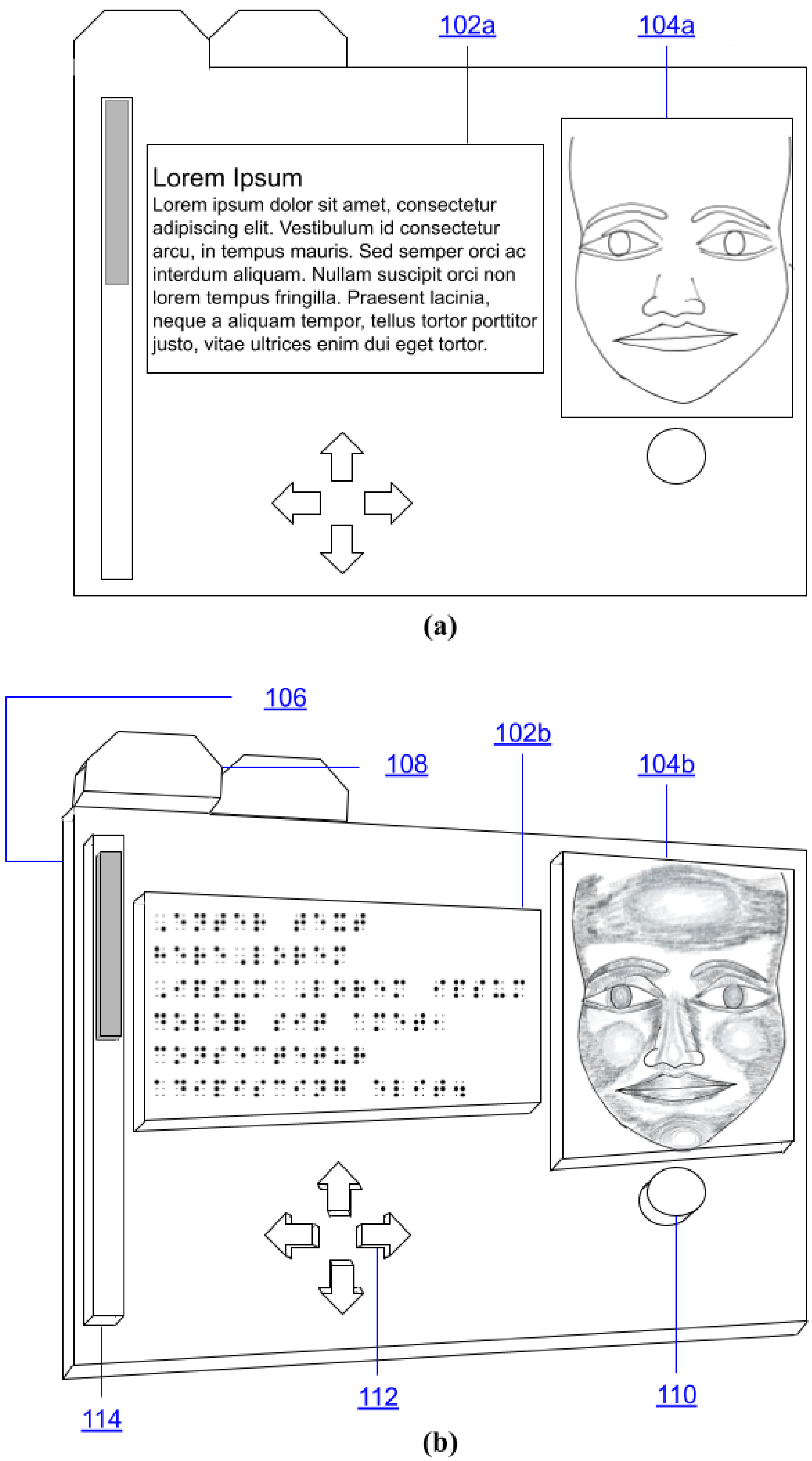

Fig. 1: (a) Conventional touchscreen; (b) Haptic touchscreen

The haptic touchscreen can be implemented in several ways, e.g., as a peripheral that plugs into a computer via ports such as HDMI or DisplayPort; as an integrated screen of a tablet or a smartphone; as a peripheral that connects to a tablet or phone wirelessly (Bluetooth/WiFi) or via a USB port; etc. The haptic touchscreen can be used in any application where screens are currently used, e.g., in tablets, smartphones, virtual assistant devices, dashboards at homes/offices, controllers, etc. The haptic touchscreen may be incorporated with a visual display or a separate.

The haptic touchscreen creates an immersive experience for users, both visually impaired and those with normal vision. Code and content development for both classes of users is streamlined. In terms of content layout and ease of interactivity, visually impaired users can have a computing experience analogous to the experience of users with normal vision. The need for native apps, as in some current screen-accessibility techniques, is obviated. Unlike refreshable braille, the described haptic touchscreen is essentially a single microelectromechanical systems (MEMS) device not requiring a complex assembly of piezoelectric crystals, pins, and levers for each braille dot; thus, it is cheaper to manufacture.

CONCLUSION

This disclosure leverages haptic technology and tactile simulation to enable users to feel the content of a screen with their fingers. Window borders, tabs, scroll bars, banner ads, clickable user interface elements, text, images, etc. become accessible to the user not only visually but also via touch. The haptic touchscreen creates an immersive experience for both visually impaired users and users with normal vision. Code and content development for both classes of users is streamlined. In terms of content layout and ease of interactivity, visually impaired users can have a computing experience analogous to the experience of users with normal vision.

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