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Touch Input Systems for the Visually Impaired

Introduction

Touch as one of the five senses act as the interface for information between the human body and the outside world. The sensory pathway, one of the two touch pathways present within the brain, processes the tactile information [1]. This includes aspects such as vibration, pressure, location, and fine texture [1]. For those who are reliant on touch as the primary sense, the sensory pathway is more sensitive to subtle differences that may be lost to those who use vision as the primary sense. This paper reviews the touch input systems available for the visually impaired, specifically systems focusing on text input.

Applications of the Touch Input System

Touch Screen

This approach encompasses several methods in which to implement a working braille touch screen for the visually impaired. All methods are designed based upon the many variations of having designated regions or gestures that make it easier to text, type, or edit using braille [2]. This is implemented with the desire to decrease the amount of times a wrong key is hit, known as hit-rate, using at least one finger up to many [2]. This method is composed of the same hardware found in any touch screen device, but has specialized software that makes typing in braille possible [2].

Another touch screen application depends upon the alignment of the on-screen keyboard with a touch-screen braille tablet app. This app aligns the keyboard below the eight fingers placed on top of the screen, no matter where they are on the screen [3]. It allows users to easily take notes while using the prevalent technology of voiceover to navigate into and out of the app.

Touchplate

Touchplates are low-cost templates that are crafted by hand, laser cutters, or 3D printers [4]. These plates are designed to be placed on-top of a standard touch screen as an overlay to help guide the user, with the added advantage of having software that recognizes the template to align the touch screen interface with the plate by simple identification tags [4]. They work with seven different function that are listed below [4].

1. Touch Inside: plates with holes to identify regions
2. Touch Outside: plates used to identify touches along the edges or corners
3. Touch Upon: plates transparent to infrared light

4. Move: translating the plate itself
5. Rotate: unique orientation to provide input
6. Place and Remove: multiple templates that alternate unique functions
7. Flip: using identification/visual tags on either side to differentiate information or functionality of a plate

Underlying Technology

Software

The touch screen software is specialized software that is created specifically for the function that it is needed. The braille touch screen discussed earlier works with software that recognizes the gestures and taps of a single finger [2]. An existing free application for the iPad, called 'iBrailler notes' mentioned within the Touch Screen section about finger alignment, also uses software to enable the identification of fingertips [5]. This software also provides preset gestures that allow for the cutting, copying, and pasting of text [5]. It provides an in-app purchase at $39.99 that allows users to export and share notes while also having access to saving an unlimited number of notes [6].

The touchplate software utilizes the scalable vector graphics (SVG) to "describes the size, shape, and location of the touchplate and its interactive areas" [4]. SVG is written in XML-based text format that allows the image to be resolution independent, meaning that it can be scaled without losing resolution [7]. An advantage is quick and easy modifications to existing templates without any need to restart the entire design process.

Hardware

Both the touch screen and touchplate method function with the same hardware components readily found within typical touch screen devices. However, the touchplate overlay can be classified as an 'external' device that interacts with the main system. Its cost is dependent upon the material used since it can be anything from cardboard to acrylic plastic, both starting from approximately $6.00 [4]. The tools needed are also dependent upon the material used, such as a laser cutter for the acrylic plastic.

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