Tactron: A Low-Cost Refreshable Tactile Graphics Display

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One of the greatest challenges for blind and visually impaired individuals (BVIs) is in learning STEM subjects. Many key concepts, like graphs and molecules, are hard to comprehend without tactile feedback, and learning is currently severely restricted by limiting tactile graphic books. Similarly, representative tactile exhibits in art museums would greatly benefit the enjoyment of art for BVIs. However, most museums can unfortunately only afford to accommodate blind patrons through semantic descriptions. Refreshable tactile graphics displays, which dynamically create custom tactile graphics, are an emerging solution. However, these displays are expensive, with the cheapest being Orbit Research's Graphiti, which costs $25k. Tactron was designed and built in this project as a low-cost alternative. The primary innovation of Tactron is using a single-actuator mechanism, driven by a coreXY-style plotter, to push up individual pins. The material cost of Tactron is just $117, a 99.5% reduction over the Graphiti. Tactron is also easy to assemble and modify—all components are 3D printed, laser cut, or standard parts. Tactron uses U2net's salient object detection to isolate image subjects, which OpenCV then processes to create edge outlines. Then, a custom compiler translates the outlines into GCode movement instructions, which are then sent to and plotted by the Arduino Uno R3 that controls Tactron. The first prototype had a 96% success rate from image to displayed pins. It will be further improved through more streamlined software for independent learning, a higher resolution mechanical design using molded pins, and a faster and more developed plotter. Tactron's low cost and ease of use will make STEM and art appreciation much more accessible for millions of BVIs worldwide.

Awards Won:
Fourth Award of $500