Engineering a Portable, Low-Cost Refreshable Braille Display for Communication with the Deaf-Blind Population

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Approximately 90% of the world's 40 million blind live in developing nations. Less than 10% of blind children in the developing world go to school due to lack of accessible materials, and literacy rates are estimated to be below 3%. Braille remains the primary method of reading and writing for the blind, but Braille books and assistive Braille technologies remain too cost prohibitive for widespread use. Our project seeks to design and engineer a durable, low-cost Refreshable Braille Display to enable communication with and facilitate reading for the blind population in impoverished nations. The final prototype consists of 42 individually controllable pins to display 7 letters at a time. An Arduino translates input from secure digital (SD) cards to Braille and transmits to the physical display using pulse width modulation to conserve energy and create consistent upward force. Our device replaces traditional costly piezoelectric actuators with a shape memory alloy of Nickel and Titanium which returns to an extended shape in response to step-wise temperature changes, pushing a pin into the up position. A matrix circuit design and a dedicated PCB per letter allows expansion of the device according to user preference without significant cost increase or alterations to the underlying design. The entire device is powered by a rechargeable lithium ion battery. Each additional letter including the actuators costs $0.24 when produced at scale, nearly 150 times cheaper than comparable commercially available displays. The computing and circuitry costs of a device which can scale up to 80 letters.

Awards Won:
Third Award of $1,000
Arizona State University: Arizona State University Intel ISEF Scholarship
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