Configurable Electromagnetic Refreshable Tactile Display With FDM Printable Bistable Cam

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Adequate access to tactile resources such as braille and tactile images is one of the largest challenges towards improving the blind or visually impaired (BVI) education level and socially connectedness. This project intends to explore hardware and software solutions on how to make a reliable configurable electromagnetic refreshable tactile display(RTD) that offers energy efficiency, flexibility, low cost, and versatility for installation. The RTD was designed, built and implemented with a novel mechanical bistable actuator that was driven by the solenoid generating electromagnetic field powered by stacked PCBs. The device connects with ESP32 using SPI. It used 3D printed parts, and commonly available electronic components, for low maintenance and cost. After a few iterations of the cam and PCB design, the RTD is verified for its refresh rate, power consumption, voltage drops, reliability and consistency. In addition, a solenoid winder was also made to wind solenoids. The thumb-size (20.8mmx31.2mm) actuator achieves 24Hz refresh rate. Benefiting from the latching structure, the actuator only consumes 0.03J when raising or lowering the dot. The average power consumption on a 12x12 RTD device is 3.24W. Lastly, the solution enables RTD cells as a straightforward peripheral for microcontrollers with SPI interfaces, as well as sharing RTD resource with IoT devices. This RTD device can effectively construct a refreshable tactile array with both rows and columns. It could benefit many blind people with easy and fast access to tactile content, as it is affordable, easily accessible and scalable.

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