Colorado Science and Engineering Fair

2025 Individual Project Abstract Form

Please print 2 copies of the completed form. Sign both copies, keep 1 for your notebook and submit 1 copy to your Regional Fair Director with your other paperwork.

Title of Project: A Haptic Guidance System for Visually Impaired Sport Climbers

Finalist's Name: Ella Music

School and City: Summit Middle Charter School

Sponsor's Name: Valerie Keeney

Category: Engineering

Division: Junior (grades 6 - 8)

Abstract (250 words or less):

A Haptic Guidance System for Visually Impaired Sport Climbers
Ella Music, Grade 8, 2025
The engineering goal of this project was to create a wearable haptic prototype for visually impaired climbers, using proximity sensors that could detect a climbing hold and give haptic feedback increasing in intensity as the climber's hand gets nearer to the hold. To create this prototype, 3 proximity sensors (ultrasonic, RFID and magnetic), an Arduino board, a haptic motor and driver, and code were written and used. The circuit was connected using either jumper wires or Qwiic cables. An unexpected challenge was learning to solder connection points for the RFID pins and haptic motor to the circuit. For each sensor, code was required to program both the proximity parameters, and the desired response in intensity of the motor for those values. Through trial and error and troubleshooting, functioning code with the desired responses was written for each sensor output. The sensor's sensing ranges were tested and compared at different angles and distances from the hold, to select the optimal sensor for on the wall application. The initial distances used for testing were at 30cm, 20 cm and 10cm from the hold and at angles from 0 to 180 degrees in 30 degree increments. Although this scale for distances worked as expected for one sensor, the other two had much shorter ranges than anticipated, and were adjusted for distances under 10cm. None of the sensors ended up meeting all of my initial criteria, so I refined my use case to select one. I plan to explore smaller and more wearable components

I hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I also attest that the above properly reflects my own work.

Finalist's Signature: Date:

In addition, all students must complete the ISEF Student Checklist (1A), Research Plan, Approval Form (1B), and Checklist for Adult Sponsor (1), and any other ISEF forms required for this type of project. See the International Rules and Guidelines for form requirements. Return COPIES of all of these forms to your Regional Fair Director with you Finalist Verification/Permission Form. **A signed copy of this form must be included in your notebook.**