



CALIFORNIA STATE SCIENCE FAIR 2014 PROJECT SUMMARY

Name(s) Raghav Ganesh	Project Number 34875
Project Title A Low Cost, Adoptable, User Tested Add-on Device for the White Cane Facilitating Safer Mobility of the Visually Impaired	
Objectives/Goals 90% of the visually impaired are unemployed, 82% are aged 50+, and the number of diabetic and elderly who are visually disabled is growing annually [WHO October 2013]. Most cannot afford or easily adapt to the expensive gadgets available (minimum \$1000). The \$50,000 cost to train guide dogs is unaffordable for many. Instead, the primary mobility aid remains the traditional white cane (\$20), which needs to be replaced every 6-12 months. Based on research and discussions with the visually disabled, my project goal is to develop an inexpensive device that augments the white cane's usage, extends its range by at least 2.5 meters, costs under \$100, weighs under 500 g, and reliably works in the real world. Abstract Methods/Materials My device computes the distance of obstacles beyond the reach of the cane by sending and measuring the time taken for ultrasonic pulses and infrared light to be reflected back from the obstacles. I used the Arduino microcontroller to compute and communicate the distance information to the user through modulated vibrations of a micro motor/servo attached to the cane's handle. I finished my project in four revisions. In each revision, I improved the software, tested various sensors & motors, and measured the accuracy of object detection. I moved these obstacles at different speeds and placed them at various distances. I also collected feedback from a real cane user after every revision. Results My final prototype successfully exceeded all design criteria and is available for demo at the science fair. My first version used an ultrasonic sensor. It detected objects up to 3 meters away with 2 cm accuracy, but missed objects that either absorbed or deflected sound. My second version used an active infrared sensor. It detected most of the objects between 0.5 to 3 meters away with 15 cm accuracy. In my third version, I improved the response time by replacing the servo motor with a Micro DC motor and modifying the software. In my final version, I used both the ultrasonic and infrared sensors to provide the best overall detection and user experience. I also incorporated a smaller microcontroller that lowered the total cost of the prototype to \$55. Conclusions/Discussion My results show that a low cost, detachable, lightweight, and responsive device can be added to the traditional white cane's usage model of sweep and tap; it can be easily adopted by the visually impaired.	
Summary Statement I created a low cost device that can be attached to the traditional white cane to help detect obstacles beyond its physical reach for the visually impaired.	
Help Received My parents funded my project and drove me to buy materials. Mr. Steve Mahan from the Santa Clara Valley Blind Center tested my prototypes and gave me valuable feedback.	