CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Shiloh S. Curtis

Project Number

34725

Project Title

Enabling Situational Awareness: A Hat-Based Hands-Free Haptic Navigational Aid for the Visually Impaired

Abstract

Objectives/Goals

According to the American Foundation for the Blind, there are over 21.2 million visually impaired adults in the U.S. However, almost all commercially available aids for this population, such as the white cane, must be constantly hand-held, depriving users of the functionality of one hand. Guide dogs can cost $60,000 and have significant care requirements. Commercially available aids have little ability to detect face and torso level obstacles such as tree branches. To answer this need, I designed and constructed a hands-free assistive hat, the Haptic Navigational Aid for the Visually-Impaired (H-NAV), to detect nearby face/torso level obstacles and indicate their location to the user.

Methods/Materials

The H-NAV uses a Laser Distance Sensor (LDS) to detect obstacles and 12 vibrating motors inside the hatband to alert the user to the obstacles' presence and direction. The motors also indicate the approximate distance to the obstacle using the duration of pulsed vibrations. The H-NAV was designed to facilitate situational awareness and enable the user to avoid face and torso level obstacles. The prototype was tested by assessing users' ability to perform common navigational tasks while blindfolded and wearing the H-NAV, where successful completion required detecting and avoiding obstacles without straying off course.

Results

Most users had overall success rates above 80%. For individual tasks, all but one of the tasks had a success rate over 85%, and the least successful task had a 76% success rate.

Conclusions/Discussion

These results indicate that the H-NAV functions as intended. It helps in navigating in common environments and detecting common face/torso level obstacles.

Summary Statement

A hat-based navigational aid for the blind which indicates obstacle direction and distance via vibrating motors in the hat band.

Help Received

Neato Robotics donated four Laser Distance Sensors; Dr. Youssef Ismail provided technological advice; Homebrew Robotics Club advised on sensors and electronics; David Curtis supervised the project.