DIVA: Spatial Navigation for the Visually Impaired Using Depth Sensing Artificial Intelligence and Convolutional Neural Networks

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Visual impairment, more severely known as blindness, has been a persistent problem in the world of biomedical sciences in which an effective, modern, and universal solution has yet to be introduced. Though health professionals and biomedical engineers have found solutions for some forms of impairment, more severe types such as Cataracts, Glaucoma, Macular Degeneration, and blindness rooted in the absence or damage to a visual system among others, are all without an economical and feasible solution. The average cost of a cornea transplant in the US was evaluated to be $32000 in 2021. Cataract surgery in 2022 cost anywhere from $6000 to $12000 when a patient without insurance needed surgery on both eyes. The approximate cost of our device is $250 - $300. Many people in underdeveloped and low to middle-income countries cannot afford these types of solutions and essentially lack access to them altogether. To put forth a modern, cost-effective solution to the problem of visual impairment, we developed visual aid to improve mobility and help the visually impaired safely navigate an unknown space based on detecting objects in the surrounding environment. The device utilizes Convolutional Neural Networks, a depth-sensing stereoscopic camera system, an RGB camera, a gyroscope, an electromagnetic solenoid tactile interface, a microcontroller, and a microprocessor. Using a custom Machine Learning model trained with 80 different object-class types, the device simultaneously classifies the obstruction as a type of object and evaluates distance from the user, providing this information to the user in an audio format based on a button-commanded system. This device can be effective in improving the lives of the visually impaired through the improvement in environmental navigation.

Awards Won:

Second Award of $2,000

Sigma Xi, The Scientific Research Honor Society: Second Life Science Award of $1,000