IVY - Intelligent Vision System for the Visually Impaired

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Globally, 250 million people have visual impairment, and many are unable to move around safely without human assistance due to the complexity of finding pathways, avoiding obstacles, risk of falling, and fear of getting lost. The resulting sedentary lifestyle can significantly deteriorate their quality of life, including adverse physical and mental health. Current methods of environmental and behaviorial interventions are ineffective. Existing approaches such as white canes, guide dogs, electronic travel aids, and smart glasses only address some challenges, and are often very expensive, costing up to $6000, limiting access to those in need. The Intelligent Vision System (IVY) developed in this research consists of four key components - the head-mounted wearable device, automated mapping and navigation algorithms, object detection model and object avoidance algorithms, and a connected smartphone app - to assist people with visual impairment to maintain mobility safely, confidently, and independently. Furthermore, audio feedback to user being slow and impractical, an Instantaneous Guidance System (IGS) with vibration feedback was invented for realtime feedback and navigation. The final IVY system fulfilled all engineering goals and criteria/constraints under a total cost of $200. All users testing the IVY system reported that the wearable device was comfortable, navigation feedback was clear and accurate, the smartphone app was easy-to-use, and overall IVY system was user friendly. IVY system had excellent performance, with positional and orientation error at 0.35 ft and 5.4 degrees respectively, while the model's object detection accuracy, classification accuracy, and localization IoU performed at 100%, 88%, and 84.9% respectively.

Awards Won:

Third Award of $1,000