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 losing balance, 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 behavioral 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. To address these challenges, The Intelligent Vision System (IVY) was developed and consisted of four key components - the eyeglasses and custom PCB, automated mapping and navigation algorithms, object detection model and object avoidance algorithms, and an audio infrastructure and smartphone app - to assist people with visual impairment to maintain mobility safely, confidently, and independently. The final IVY system fulfilled all engineering goals and criteria/constraints under a total cost of $300. The eyeglasses design was comfortable, the IGS and audio navigation feedback was clear, accurate, and in real-time, the audio infrastructure and smartphone app were easy-to-use, and the overall IVY system was user-friendly. IVY system had excellent performance, with positional and orientation error at 0.35 ft. and 5.4 degrees (indoor) and 1.6ft and 5.4 degrees (outdoor) respectively, while the model's object detection accuracy, classification accuracy, and localization IoU performed at 100%, 88%, and 84.9% (indoor) and 100%, 95.5%, and 90.8% respectively.

Awards Won:
Second Award of $2,000
Association for the Advancement of Artificial Intelligence: AAAI Student Memberships for each finalist that is part of the 1st, 2nd, and 3rd Prize Winning projects and 5 Honorable Mention winning projects (up to 3 students per project) (in-kind award / part of the 1st-3rd prize)
Association for the Advancement of Artificial Intelligence: Second Award of $1,000