Engineering A Novel Autonomous Wheelchair System for the Visually-Impaired and Quadriplegic Individuals

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Major advances in artificial vision have the ability to aid the visually-impaired and create systems designed to improve the mobility and independence of the affected individuals. In 2002, about 250,000 Americans have spinal cord injuries, and 47% of these spinal cord-injured individuals are considered quadriplegic (University of Alabama, 2002). As of October 2013, 285 million individuals worldwide were estimated to be visually-impaired (WHO, 2013). Of these, 39 million are blind and 246 million have low vision. These statistics have inspired me to design and develop an autonomous wheelchair (AW) system applicable to both the visually-impaired individuals and quadriplegics. The AW system that I designed and developed, uses a camera to detect three important safety markers: 1) crosswalks, 2) pedestrian traffic signals, and 3) sidewalks. In addition, the AW system uses ultrasonic PING sensors and Google Maps to prevent the system from colliding with pedestrians/obstacles in front of the wheelchair, and to provide a path to the location of interest, respectively. I also created algorithms to detect elevated paths such as stairs and uneven terrains to avoid problems during movement. Further testing improved consistency of algorithms in low light and bad weather. Future tests will include cost-analysis to achieve a lower costing AW system.This price reduction will allow widespread accessibility and affordability and provide these visually impaired individuals and quadriplegics who need the AW system independence and mobility. Additionally further expansion on these algorithms can provide further development for autonomous vehicles and systems for those who need them.