

UTC Spotlight

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Transportation for Populations with Disabilities

Transportation is essential for people with disabilities and older adults to participate in society. It impacts access to healthcare, essential goods and services, interactions with friends and family, and ability to work or attend school, as well as a host of other activities. The Automated Vehicle Services for People with Disabilities—Involved Responsive Engineering (ASPIRE) Center at the University of Pittsburgh is studying how people with disabilities and older adults are affected by access to safe, reliable, timely, and accessible transportation. There are many aspects of accessible transportation and the team of researchers at ASPIRE are addressing areas that need improvement. Driving is regarded as an important aspect of personal freedom and autonomy; however, access is very restricted for non-drivers, especially if they live outside the largest metropolitan areas with limited access to public transportation.

Approximately one billion people in the world have some form of disability and an estimated 25.5 million Americans experience a travel-limiting disability. Mitigating transportation-related barriers for people with disabilities would enable new employment opportunities for approximately two million people with disabilities and save \$19 billion annually in healthcare expenditures from missed medical appointments alone. This is in the context of the anticipated broader impacts of autonomous vehicles: \$1.3 trillion in savings from productivity gains, fuel costs, accident prevention, and other sources.

The transportation industry is in the middle of one its largest transformations, with unprecedented investment and advancements in electric and autonomous vehicle (AV), and autonomous transportation system (ATS) technologies. These efforts have produced significant advances, but the technological, psychological, and regulatory constraints remain.



Minivan rider using remote control to operate the Mobility-Enhanced Robotic (MEBot) wheelchair.
(photo credit – Jorge Candiotti)

The Society of Automotive Engineers (SAE) provides a common taxonomy and definitions for automated driving to simplify communication and facilitate collaboration within technical and policy domains. SAE defines more than a dozen key terms and provides full descriptions and examples for each level of autonomy. However, it neglects to address usability and accessibility for people with disabilities.

In its report entitled “Self-Driving Cars: Mapping Access to a Technology Revolution” the National Council on Disability explored the “*emerging revolution in automobile technology and the promise it holds to for people with disabilities, as well as the obstacles the disability community faces*”

to realize that promise." The report makes several key recommendations: research and development of AVs and their components should include a requirement that demonstrates that any resulting products incorporate accessibility of people with diverse disabilities, and these technologies should be required to comply with Section 508 of the Rehabilitation Act; guidelines are needed for how people with disabilities can safely interact with and use AVs; and all types of common and public use AVs must be fully accessible.

A survey conducted by ASPIRE confirmed that advancements in technologies related to transportation are very important to individuals with disabilities and represent a significant unmet need. Over 60% of the more than 1000 respondents rated the importance of technology in meeting their personal mobility needs (e.g., home, work, neighborhood) as "critical," and over 40% felt that traveling freely (e.g., vacation, cruise, airline, bus, taxi, train) was also "critical." Of those participants who provided comments, approximately 12% mentioned transportation, with "self-driving" vehicles representing about 50% of the transportation comments.

A systematic review of the public-focused and scientific literature conducted by ASPIRE on AV and ATS for people with disabilities showed research was limited to four observational studies with a very low level of evidence, qualitative studies, reviews, design and model reports, and policy proposals. Studies focused on older adults were the most common. Public-focused literature spanned a variety of media and sources and focused on a variety of disability and impairment types. Results highlight opportunities and barriers to accessible and usable AV and ATS, outline gaps to set a future research and development agenda and identify implications for policy and knowledge translation. People with disabilities are a diverse group and accessible and usable design solutions for AV and ATS will therefore

need to be tailored to each group's needs, circumstances, and preferences. Future research in diverse disability groups should include more participatory action design and engineering studies and higher quality, prospective experimental studies to evaluate outcomes of accessible and usable AV and ATS. Studies will need to address not only all vehicle features but also the entire travel journey.

Interviews with people with disabilities about how they plan and complete trips using current modes of transportation reveal some of the challenges faced and provide insight into requirements to make AVs and ATS accessible. Non-drivers reported relying on others (including the vehicle drivers) for a variety of assistance to include securing their wheelchair and engaging occupant restraints, assisting with loading bags/packages, identifying accessible entrances, helping to transfer into the vehicle seat, loading their mobility technology, providing orientation to surroundings, and much more. People also identified challenges that include a wide timeframe provided for pick-up and drop-off that often require people to leave events very early or to arrive late, and potentially involve extended ride times based on scheduling of pick-ups and drop-offs. For example, a trip that normally would take 15 minutes could take over two hours. Some other examples cited incidences that placed people at risk, such as being dropped off on a traffic island by a bus, stranding the powered wheelchair user until the next bus could transport the person a few yards to be able to continue to their intended destination.

AV and ATS technologies have the potential to drastically improve access for people with disabilities; however, these individuals are underserved by current AV and ATS technology development. ASPIRE UTC's goal is to provide guidance and demonstration projects to assist with achieving the goal of building transportation capabilities that are enabling and empowering.

About This Project



The Automated vehicle Services for People with disabilities – Involved Responsive Engineering (ASPIRE Center) is co-led by Professors Rory A. Cooper, PhD and Brad E. Dicianno, MD, MS at the University of Pittsburgh (Pitt). The ASPIRE Center is a partnership of three academic institutions: Pitt, Catholic University of America, led by Prof. Lavinia Fici-Pasquina, and the Uniformed University of Health Sciences led by Prof. Paul F. Pasquina. The ASPIRE Center team includes engineers, healthcare providers, data scientists, designers, and end-users. It is engaged with the emerging industry in this space as well as advocacy organizations.

This newsletter highlights some recent accomplishments and products from one University Transportation Center. The views presented are those of the authors and not necessarily the views of the Office of the Assistant Secretary for Research and Technology or the U.S. Department of Transportation.

