EXPLORATORY ADVANCED RESEARCH

Technological Innovations in Transportation for People with Disabilities

2011 WORKSHOP EXECUTIVE SUMMARY

U.S. Department of Transportation

Federal Highway Administration

Background

Technological advancements could help to empower people with disabilities by addressing their mobility needs, however, the benefits of such advancement have not yet reached this segment of the traveling public. There is an opportunity to explore the suite of new technologies, such as wireless, dedicated short-range communication (DSRC), global positioning systems (GPS), object detection, and robotics to find methods, tools, or devices that offer persons with different impairments accessible transportation to meet their personal mobility and public transportation needs.

The Federal Highway Administration's (FHWA) Office of Operations Research and Development (R&D), with the Exploratory Advanced Research (EAR) Program, intends to examine current and future advancements in Intelligent Transportation Systems (ITS) and other technologies that could provide broad safety and mobility benefits for pedestrians, and targeted assistive technology to improve accessible transportation for people with vision impairment and other disabilities. It also aims to identify opportunities and share knowledge and experience on how various technologies, such as mobile computing, computer vision, artificial intelligence, and robotics could be integrated to assist people with disabilities to be more mobile and independent.

The Workshop

FHWA's EAR Program focuses on long-term, high-risk research with a high payoff potential. The program addresses underlying gaps faced by applied highway research programs, anticipates emerging issues with national implications, and reflects broad transportation industry goals and objectives.

On February 23, 2011, at the Turner-Fairbank Highway Research Center (TFHRC) in McLean, VA, FHWA's Office of Operations R&D, with the EAR Program, convened a 1-day workshop on technological innovations for people with disabilities. The focus was to find new ways to improve mobility for people with disabilities by using anticipated and current technologies and building on existing infrastructure.

The workshop began with Michael Trentacoste, Associate Administrator for FHWA's Office of Research, Development, and Technology (RD&T) and Director of TFHRC, welcoming attendees and providing a brief overview of FHWA's involvement in transportation accessibility, and the importance of improving highway facilities for all users. Joe Peters, Director, Office of Operations R&D at FHWA, then outlined the importance of raising awareness of people with disabilities and addressing individual user requirements. Next, David Kuehn, EAR Program Manager at FHWA, offered insight into the application of long-term research to enable the public to travel safely with greater mobility and greater access. Richard Devylder, Senior Advisor on Accessible Transportation at the U.S. Department of Transportation, then presented his thoughts on technology solutions to mainstream accessible transportation and ensure functional needs are being met. Finally, Mohammed Yousuf, Office of Operations R&D at FHWA, provided insight into the importance of technological innovations in transportation for people with disabilities and addressed the suite of new and emerging technologies now available.

A panel of six speakers then presented on technological advancements, and existing and developing tools, methods, and concepts related to pedestrians with vision-impairments and other disabilities. Following these presentations, the speakers, disability experts, and representatives from academia, the transportation industry, and other professional areas, discussed applications to wayfinding and guidance, identified knowledge gaps and opportunities, and highlighted barriers to implementation.

Presentation Summaries

Speakers presented on a range of topics, from economics, environmental awareness, and accessibility to robotics, wayfinding, and mobile technology. Here is an overview of the six presentations:

1. Triggering a Virtuous Circle of Self-Sustaining Accessibility and Transportation

David Lewis, Senior Vice President at Henningson, Durham & Richardson, Inc., highlighted the ongoing struggle to understand the relationship between public policy regarding technology and the penetration and commercial realization of design and technology solutions that improve the lives and wellbeing of people with disabilities. He explained the need for public policy "nudging" to trigger a self-sustaining market for accessibility, and the importance of making a business case by quantifying all benefits of a new technology.

2. Environmental Awareness for People With Visual Impairments—Gaps, Challenges, and Opportunities

Gil Lutz, Chief Pioneering Officer at Sendero Group, provided an overview of the Sendero system that provides talking GPS navigation. Using a comprehensive and customizable point of interest database, the system can offer specific directions both on- and off-street and allows a user to retrace any route using step-by-step guidance.

3. Getting There if You Are Blind: Synergistic Convergence of Technologies to Improve Wayfinding

Bill Crandall, a scientist at Smith-Kettlewell Eye Institute, focused on overcoming barriers faced by people with visual impairments as they travel around on a day-to-day basis. Tools discussed included tactile print maps, GPS, geographic information systems, and remote infrared audible signs (RIAS). The RIAS system labels the environment and has many applications, from bus stops and elevators to pedestrian crossings. RIAS can also be merged with mobile technology to access an information database stored on a remote server.

4. Using Robotics and Artificial Intelligence to Improve Mobility and Navigation of People With Special Needs

David Bruemmer, Vice President of Research at 5D Robotics, offered insight into the role of service robots. The market is expected to progress rapidly in the coming years, so it is important to find the right task allocation for robots to meet specific requirements. Robotics may include both autonomous and assistive functions and systems. In addition, understanding capabilities and maintaining simplicity are key factors to consider.

5. Opportunities and Innovations in ITS and Mobile Technology for Accessible Transportation

Larry Head, Department Head of Systems and Industrial Engineering at the University of Arizona, demonstrated the benefits of a connected environment, explaining the benefits offered to all road users, from emergency vehicles approaching an intersection, to pedestrians waiting at a crosswalk. The ultimate vision of this research is for a completely connected vehicle and infrastructure environment, utilizing systems that communicate with roadside equipment using a selection of tools, from DSRC to phone networks and Bluetooth.

6. Making Technology Universally Accessible for All Users, Including Those With Sensory and Cognitive Impairments

Katharine Hunter-Zaworski, Director at the National Center for Accessible Transportation at Oregon State University, presented on making technology universally accessible to all users. The urban-rural accessibility divide was highlighted, as well as many of the new technologies aimed at improving access for all, including handheld devices, video phones, and accessible information systems. Some of the steps required to enable widespread deployment were also covered, particularly the importance of making a business case to ensure that technologies can reach the intended end user.

State of Technology

Many of the new technologies discussed at the workshop offer benefits for those with disabilities. ITS, wireless technologies, robotics, artificial intelligence, navigation, guidance, universal design, and accessible transportation; all offer access to daily activities such as independent travel to work, school, shopping, or recreation.

ITS, wireless technologies, and mobile computing can enable a person to cross a roundabout equipped with knowledge of the surrounding environment and traffic conditions, while broadcasting and receiving information with the infrastructure and vehicles. Robotics, artificial intelligence, and object detection technology can detect hazards and obstructions on sidewalks or offer assistive navigation solutions.

Navigation, wayfinding, orientation, and guidance technology can be used to enhance mobility. It can allow a person with a visual impairment to navigate a crowded station or find his or her way around unfamiliar buildings. Universal design and accessible technologies aim to keep accessibility simple, often looking to integrate new technology with a device that is already carried by the person.

Although there are a lot of useful and often life-changing technologies in existence, there are also many technologies that do not work well for all people. As new technology is developed and introduced, it is critical to users that it be reliable.

Workshop Findings

Following the morning presentations, small breakout groups identified gaps, challenges, and opportunities specific to a range of topics.

Some of the issues related to ITS, wireless technologies, and mobile computing were considered as a series of basic travel needs to be met, from the ability to receive information on a mobile device, to sharing real-time transit information over a network. The proliferation of smart phones points to many future applications for such devices, although affordability and overall cost to access this technology need to be kept in mind. To fully leverage technology requires open access to travel information data.

Discussion of robotics, artificial intelligence, and object detection covered some of the many problems facing a visually-impaired traveler on a daily basis; from identifying departure information, purchasing a fare, boarding the correct vehicle, and disembarking at the correct stop, to avoiding obstacles and traffic along the street, and finding crosswalks and signals. In addition, assistive technology can find ways to improve overall spatial awareness.

The navigation, wayfinding, orientation, and guidance group highlighted the need to consider a multimodal journey when attempting to implement wayfinding technology for the visually impaired. Improved access from technology could improve the confidence of travelers with disabilities. Access to wayfinding information is inconsistent and for a traveler to want to start carrying around a wayfinding device, the technology needs to be implemented on a large scale. The overall finding was to improve access for all and offer technology to improve the confidence of travelers with disabilities.

When examining issues pertaining to universal design and accessible transportation, the objective is to eliminate unexpected obstacles to make getting around, whether on a sidewalk or a transit system, as seamless and barrier-free as possible. A level playing field is needed, with cross-disability support provided in multiple formats.

Improving Accessibility: Moving Beyond Research

General discussion at the end of the workshop was designed to identify potential topics worthy of research investment.

The importance of sharing information between interested parties was considered key to moving forward. Certain organizations, such as the National Council on Disabilities, already gather detailed information about barriers faced in transportation to continue outreach and coordination so research can respond to national needs.

There have been many cases of a new technology that would be of great benefit to many people and Government policies can support a path for new assistive technologies and markets to thrive.

Finally, many new technologies could offer a different way to carry out a task, but to make a case for investors, the true benefits need to be accurately measured. Quantitative and qualitative assessments of the potential impact of a new technology on the end user should be identified, and given that travelers with disabilities have wide variation of wants and needs, the target population should be involved at all stages.

Learn More

For more information on the Technological Innovations in Transportation for People with Disabilities workshop, contact Mohammed Yousuf at FHWA, 202-493-3199 (email: mohammed.yousuf@dot.gov). To learn more about the EAR Program, visit the Exploratory Advanced Research Web site at www.fhwa.dot/gov/advancedresearch, or contact David Kuehn at FHWA, 202-493-3414.