Proposed priority--National Institute on Disability, Independent Living, and Rehabilitation Research

SUMMARY: The Director of the National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR) proposes a priority for a Disability and Rehabilitation Research Project (DRRP) entitled: Robotics and Automation Technology Application Development Supporting Independent Mobility.

Invitation to Comment: We invite you to submit comments regarding this proposed priority. To ensure that your comments have maximum effect in developing the final priority, we urge you to identify clearly the specific topic within the priority that each comment addresses. Please note that we are only accepting comments on the priority. We are not accepting comments on the background section that precedes the priority.

DATES: We must receive your comments on or before **May 20, 2016**.

ADDRESS: Address all comments about this notice to Marlene Spencer, at Marlene.Spencer@acl.hhs.gov. You must include the phrase "Proposed Priority for Transportation DRRP" in the subject line of your electronic message.

Title: Robotics and Automation Technology Application Development Supporting Independent Mobility

Background Statement:

In 2010, the U.S. Census reported that approximately 56.7 million people in the U.S. (18.7 percent of the U.S. population) had some type of disability. One study,[i] found that over 6 million people with disabilities have difficulties obtaining the transportation they need; nearly one-third of people with disabilities reported having inadequate access to transportation[ii]. This is an important consideration as transportation has long been thought to be instrumental in enhancing access to education, jobs, healthcare, and independent living in the community.[iii] [iv] [v] [vi]. Currently among individuals with disabilities there is a 63 percent unemployment rate, with half of the household income and three times the poverty rate of people without disabilities.[vii] Recently, a user needs assessment on transportation challenges faced by people with disabilities, veterans with disabilities, and older adults, conducted by the United States Department of Transportation's Accessible Transportation Technology Research Initiative (ATTRI), concluded that needs and barriers vary by sub-population and type of disability. The assessment identified mobility concerns as barriers to employment, recreational

and retail opportunities, and other meaningful lifetime activities.[viii] "Independent mobility" refers to the ability for an individual to travel to a destination without being accompanied by a family member or caregiver regardless of functional ability. Specific barriers identified by ATTRI stakeholders included lack of or inaccessible signage, maps, and announcements; lack of information on arrival times, transfer times, and travel distance; and inconsistent accessible pathway infrastructure. Users asked for amenity information; real-time transportation information; and safety, security, and emergency information. Additional information on this study and the ATTRI program is available at: http://its.dot.gov/attri.

Robotics and automation technologies have the potential to bring about many transformational changes to these independent living and overarching transportation barriers. Research efforts are underway showing potential benefits of robotics and automation for personal independent mobility.[ix] [x] [xi] [xii] Robotic and automation technologies impact our lives behind the scenes every day, and now these technologies are becoming more apparent in our everyday lives. Applications in robotics currently under development include collaborative robots that not only assist with activities in daily life such as walking, but also work with individual travelers and human transportation services to provide related concierge services at different stages of their travel and hence improve personal and independent mobility across the entire transportation network, including transportation terminals, home, work, and healthcare destinations.

Major efforts to support development of fully autonomous vehicles (FAVs) are underway in both the public and private sector. For instance, the USDOT has recently launched the Automated Vehicle Research program. USDOT research aims to enable and accelerate the development and deployment of connected and automated vehicles; ensure safe and efficient operations of emerging technologies and systems; and maximize public benefits by leveraging connected vehicle technologies, infrastructure-based solutions, and other approaches.[xiii] Private sector technologists, companies, and car manufacturers are also developing and testing personal automated vehicles. Similarly, in Europe, research and development activities such as CityMobil2 have been implementing and testing automated transit vehicles in urban environments[xiv].

For surface transportation, advances in these emerging technologies offer a promise of improved mobility including greater safety, energy efficiency, and better multimodal connectivity and accessibility. FAVs and robotics are expected to improve mobility for those unable or unwilling to drive and enhance independent and spontaneous travel capabilities for all travelers, including solving first mile/last mile mobility issues, providing connections for all travelers to existing public transportation or other transportation hubs, and addressing "door through door" travel. These technologies and other such applications, whether incorporated

into vehicles, personal devices or within terminals, might also enable virtual caregivers or concierge services the ability to guide travelers and assist with decision making.

NIDILRR is seeking to fund research on the use of robotic and automated technologies to enhance overall transportation options for individuals with disabilities. In recent years, NIDILRR has supported the U.S.DOT's ATTRI program. NIDILRR will continue this collaboration by funding this proposed research initiative leading to the development, prototyping, and demonstration of robotics and automation technologies to support improved and independent mobility for individuals with disabilities.

In carrying out this priority, applicants should consider the following three constructs as they propose accessible transportation technology based on robotics and automation.

Use of Standard Accessible Data Platform

Data standardization and interoperability is critical in developing applications which aspire to enhance the personal mobility of those with the greatest needs. Data must begin to work across service providers, utilize available real-time data sources and communicate in an efficient, succinct, and adaptable manner to meet individual user needs with various degrees of abilities. Technology applications to be considered for development will provide almost ubiquitous access to a wealth of real-time, situational data sources, including data specific to transportation systems, municipalities, points of interest, crowd-sourced information in accessible formats utilizing inclusive information and communications technology (ICT). Applications may consider existing standardized data or identify new data sets to create user profiles allowing smoother access and transferring between accessible transportation services.

Review and Inclusion of Universal Design Standards

Universal design standards incorporate a philosophy that espouses to maximize the applicability of a technical solution to the needs of all user groups. In relationship to application development, it is presumed that all work attributed to building applications pursue universal design principles including inclusive Information and Communications Technology (ICT) solutions such as accessible electronic interface technology. Implementation of such principles in development could include leveraging existing solutions and enhancing them to meet the needs of all users, such as user-centered and responsive design approaches and personalization techniques.

Development and Utilization of Methods of Integrated Payment

Integrated payment systems typically incorporate interoperable electronic fare payment media and technologies that can be utilized across all modes of transportation, at all times, perhaps for multiple consumer purposes, including leisure, recreational and healthcare expenses. The vision for a multimodal integrated payment system is to deliver, for travelers in the transportation ecosystem, the ease of use and convenience that comes from one real-time electronic payment system and extend that ease across modes and through institutional and technical collaborations. Integrated payment solutions should accommodate all users, including those with mobility, vision, hearing, and cognitive disabilities. In such cases where possible, consideration should be given to integrate payment solutions with any application or device such as embedding it on a power wheelchair or on a robotic device.

Priority:

The purpose of this priority is to advance the development of technology applications in robotics and automation that enhance accessible transportation for travelers with disabilities and to improve opportunities for a seamless travel chain that:

a) meets the diverse needs of travelers with mobility, vision, hearing and cognitive disabilities; and
b) provides them the ability to plan and execute on-demand trips at any time and from any location.

To do this, the grantee will engage in development of operations procedures, system requirements, and prototypes and will conduct demonstrations for target groups and stakeholders. One of the outcomes of this work will be the identification of assistive technology applications in robotics and automation that enhance and improve transportation alternatives for people with disabilities, veterans with disabilities, and older adults.

NIDILRR intends to fund this project as a cooperative agreement to enable a significant amount of interaction between the grantee and NIDILRR staff. We are taking this step because this priority is part of a larger initiative involving both the Department of Health and Human Services and the Department of Transportation.

The Administrator of the Administration for Community Living (ACL) establishes a priority for the funding of a Disability Rehabilitation Research project (DRRP) on Using Robotics and Automation to Improve Accessible Transportation Options for Individuals with Disabilities.

To contribute to this outcome, the DRRP must—

(a) Conduct research and development activities, on one or more robotics and/or automation applications, for accessible transportation leading to increased personal mobility and independent living for individuals with disabilities. Examples of priority areas include, but are not limited to:

- Slow-speed reliable and accessible connected and automated vehicles which would leverage robotic assistance to destinations in constrained environments to solve first mile/last mile and multimodal connection issues.
- Shared resource robots available for use at transportation hubs, be it a metro/bus stop or other multimodal hub where personal vehicles would be available on a personal basis to navigate to the next destination, and leave that resource for the next user to use.
- Assistive robot that understands disability types and their needs to offer services including help with wayfinding and navigation, transfer of luggage or securing a boarding pass etc.
- Automated robotic characterization of pedestrian environments and navigation assistance through the use of crowdsourced/fleet accessible real-time information.
- Interior design of FAVs for accessibility and safety, reflecting current crash test data.

(b) In carrying out the research and development activities in (a), applicants shall strongly consider, as appropriate, the following:

- The foundational considerations:

    1. Use of a Standard Accessible Data Platform
    2. Review and Inclusion of Universal Design Standards
    3. Development and Utilization of Methods of Integrated Payment

- Inclusion of and compatibility with existing transportation infrastructure as well as existing and emerging enabling technology solutions.

- Feasibility of developing products that can be market ready within 5-10 years or earlier, with tangible cost and benefit scenarios.

- Institutional and policy aspects of the proposed application(s) and their use by stakeholders within the designed operational environments including demonstration phases.

(c) Identify and justify the stage(s) of research being proposed. If the DRRP is to conduct research that can be categorized under more than one stage, including research that progresses from one stage to another, those stages must be clearly specified. These stages--exploration and discovery, intervention development, intervention efficacy, and scale-up evaluation--are defined in this notice;

(d) Identify and justify the stage(s) of development being proposed. If the DRRP is to conduct development activities that can be categorized under more than one stage, including development that progresses from one stage to another, those stages must be clearly specified. These stages—proof of concept, proof of product, and proof of adoption-- are defined in this notice;

(e) Coordinate as appropriate with USDOT related accessible transportation research efforts including, but not limited to, the Accessible Transportation Technologies Research Initiative (ATTRI), Universal Automated Community Transport (UACT), and Smart Cities.

(f) Conduct knowledge translation activities (i.e., training, technical assistance, utilization, dissemination) in order to facilitate stakeholder (e.g., individuals with disabilities, employers, policymakers, practitioners) use of the interventions, programs, technologies, or products that resulted from the research or development activities conducted under paragraph (a) of this priority; and

(g) In coordination with NIDILRR staff, meaningfully involve key stakeholder groups, including existing relevant committees within and outside of government, in the activities conducted under paragraph (a) of this priority in order to maximize the relevance and usability of the research or development products to be developed under this priority.

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[i] U.S. DOT Bureau of Transportation Statistics, Issue Brief: Transportation Difficulties Keep Over Half a Million Disabled at Home, 2003

[ii] National Organization on Disability, N.O.D./Harris Survey of Americans with Disabilities, 2000. Available at: http://www.nod.org/content.cfm?id=798

[iv] California State Independent Living Council, "Traveling Poses a Unique Set of Challenges for People with Blindness", Sharing Information Loud and Clear Newsletter - May 2014, available at: http://www.calsilc.org/

[v] Mullen, R., & Hoelzel, L. (2012, July 14). Using Smart phones and WayFinder to Increase Independent Mobility of Adults with Developmental Disabilities. In ARCA. Retrieved July 16, 2015, from http://www.arc-a.org/Services/White%20Paper%20SMART%20Travel%202012.pdf

[vi] Ganous, T. J. (2007). Restoring Independent Mobility for Wounded Warriors and Severely Disabled Veterans: A New Class of Personal Transportation Vehicles. In http://www.resna.org/. Retrieved from http://www.resna.org/sites/default/files/legacy/conference/proceedings/2007/Policy/Mobility/Ganous.html

[vii] Cornell University, 2012 Disability Status Report (United States), 2012, http://www.disabilitystatistics.org/StatusReports/2012-PDF/2012-StatusReport_US.pdf

[viii] Accessible Transportation Technologies Research Initiative (ATTRI), User Needs Assessment Report, U.S.DOT, Final Report — March XX, 2016, FHWA-JPO-16-TBD. Interim report available at: www.its.dot.gov/index.htm

[ix] Hashimoto, Naohisa et al (2015) Promoting Independent Mobility -Assistance mobility and evaluation technology in robotic wheelchair, available at: http://robotics.ntua.gr/IROS2015-Workshop-Cognitive-Mobility-Assistance/pdfs/IROS2015-workshop_8-Hashimoto-et-al.pdf

[x] Anandan, Tanya (2014) "Our Autonomous Future with Service Robots", Robotic Industries Association, available at: http://www.robotics.org/content-detail.cfm/Industrial-Robotics-Industry-Insights/Our-Autonomous-Future-with-Service-Robots/content_id/4925

[xi] Spenko, Matthew et al (2006) Robotic Personal Aids for Mobility and Monitoring for the Elderly, IEEE Transactions on Neural Systems and Rehabilitation Engineering, Vol 14. No. 3, September 2006, available at: http://robots.mit.edu/publications/Spenko-RoboticPersonalAids.pdf

[xii] Worchester Polytechnic Institute, "WPI Developing Intuitive, Robotic Wheelchair" News & Events 2014-2015, available at: https://www.wpi.edu/academics/robotics/news/20145/Robotic%20Wheelchair.htm

[xiii] USDOT's Automated Vehicles Research Program website: http://its.dot.gov/automated_vehicle/avr_plan.htm#sthash.3lfb525b.dpuf

[xiv] CityMobil2 website: http://www.citymobil2.eu/en/