

ATTRI Application Areas

During the exploratory phase of the program, ATTRI conducted technology scans, a comprehensive user needs analysis of ATTRI's target populations and functional disabilities, solicited information through a Request for Information (RFI) and conducted extensive stakeholder outreach. Based on this information, the U.S.DOT has determined four (4) priority areas for the development of ATTRI applications:



Smart Wayfinding and Navigation Systems

Traveling in new or unfamiliar environments can be challenging for travelers with disabilities, especially those with low vision, blindness or cognitive disabilities. Lack of information of the built environment, obstacles along the route, and poor accessibility can increase mobility challenges. Travelers with disabilities can also face many challenges on routes that are unfamiliar to them. Environmental or route changes, or delays on their usual routes or modes of transportation can greatly increase personal mobility challenges. ATTRI seeks to develop innovative solutions to mitigate these challenges.

Applications developed within the smart wayfinding and navigation realm will provide real-time, en-route assistance and situational awareness to ensure travelers can safely reach their destinations while traveling independently. These technologies could include, but are not limited to: wayfinding and navigation systems for indoor and outdoor use, beacons or electronic tags to interact with the built and pedestrian environment, transmittable data in multiple communication formats (visual, audible, haptic) including multiple languages, wearable technologies acting as discreet assistive navigation tools, connection with assistive devices mobile devices already in use (e.g. white cane, wheelchairs, smartphones), and the use of community volunteers providing accessibility data on neighborhoods, buildings, and infrastructure elements, including crowd sourced public/private maps for indoor and outdoor spaces for the real-time use of travelers with disabilities. Processes that affect wayfinding and navigation include: familiarization, localization and orientation, path planning, path traversal (locomotion), guidance, annotation, update and communication.

Wayfinding and Navigation solutions will assist with waypoint navigation, path planning, advanced warning of events, recovery from route mistakes, navigation in unfamiliar locations and changes in environment by using Global Positioning System (GPS), geographic information system (GIS), Information and Communication Technology (ICT), and intelligent transportation system (ITS) equipment and technologies. These applications will then recognize and detect stationary objects (e.g., doors, elevators, stairs, crosswalks, and traffic lights), read and recognize important text and signage based on a user's query, and detect, track, represent moving objects and dynamic changes to a traveler's environment (e.g., people, shopping carts, doors opening, and moving vehicles), and provide one button push notification to send location information from a smartphone to a van or bus. Wearable sensors, such as cameras, three-dimensional orientation devices, and pedometers, may be used in conjunction with a display unit to provide auditory and tactile guidance.

While there is useful data in existing map systems, they often lack critical data relevant to ATTRI stakeholders. For example, a Points of Interest database may give the location of a store, but not where the entry door is, whether there are steps at the door, or if a restaurant has an accessible bathroom. In addition, wayfinding and navigation systems can support the transition from paratransit to fixed route transit services.

Pre-Trip Concierge and Virtualization

Safety concerns, insufficient traveler information and unfamiliar environments can make it challenging for travelers with disabilities and older adults to achieve full independence. ATTRI aims to develop solutions for all travelers to safely and confidently travel independently from their point of origin to their desired destination. These solutions should not only provide easily understandable, reliable and complete pre-trip and en-route information to help guide the traveler to their destination but also communicate with caregivers of the traveler's status and alert them of any changes or issues along the way.

Technology solutions focusing on providing pre-trip concierge services and route virtualization could include, but are not limited to: providing pre-trip and en-route traveler information throughout the trip, design for people with blindness,

low vision, cognitive and mobility issues, passengers having the ability to “see” their entire routes on an app with landmarks (to remove fear and facilitate independent mobility) and contextual details with augmented voice overlays, and virtual caregiving technology which helps plan routes, track travelers movement and provide connectivity to caregiver and family members.

Applications in this area could include new technology solutions that assist travelers with activities in everyday life such as walking or getting to work seamlessly with unique traveler mobility needs and human transportation services to provide concierge services at different stages of travel. Applications could include improved personal mobility including the ability to learn and remember routes across the transportation network by integrating data, personal needs and profiles alongside available services. Applications could also relay traveler information for multiple transportation choices including cost, accessibility accommodations, distances, travel times, and integration with other modes for first mile, last mile options. Machine vision, Artificial Intelligence, assistive robots, and facial recognition software could help solve a variety of travel related issues for people with disabilities in vehicles, through the use of devices or at terminals creating virtual caregivers or concierge services helping guide travelers and assisting with decision making while connecting with their caregivers and family members. For example, if applications in this area were applied to transit systems and stations, virtual exploration devices could have the potential to help visually impaired travelers familiarize themselves with the layout of a building or of the overall transportation network. In addition, for users of paratransit and taxicab type services, applications could track vehicle location and how long it would be before it arrives at the pickup location.

Additional examples of applications in this area could include; planning, reservations, and travel itinerary solutions for people with disabilities, pre-trip and en-route crowd-sourced traveler information, technical design solutions for people with blindness, low vision, cognitive and mobility issues, technologies which enable passengers “see” their entire routes on an app with landmarks, , or virtual caregiver applications which help plan routes and track travelers movements including creation of voice assistant applications (such as Apple’s Siri) with a voice overlay of a family member to help those with cognitive disabilities. Applications in this area may leverage use of emoji’s for accessible transportation solutions for easier interpretation of information on smartphone apps and transportation infrastructure.

Shared Use, Automation and Robotics

Automation and robotic technologies have the potential to bring about many transformational changes to these transportation barriers. Automated vehicles have the potential to provide greater safety, mobility, and energy efficiency. Currently available technologies include precision docking of vehicles to reduce the needs for bridges and ramps, personal rapid transit (PRT) vehicles that utilize small unmanned automated vehicles to take travelers to their destinations, and vehicle control and safety systems such as motor-operated car seat lifts, backup cameras and blind spot warning systems, keyless entry and keyless ignition, automatic transmissions, automatic locks and windows, adjustable pedals and cruise control, parking assistance, collision warning, and lane-keeping systems. In addition semi- or fully- autonomous small vehicles such as electric golf carts and segways have the potential to address first mile, last mile challenges.

There are currently major efforts to support development of autonomous vehicles. For instance, the USDOT has recently launched the Automated Vehicle Research program. USDOT research aims to enable and accelerate the development and deployment of 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. 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.

Likewise, robotic technologies continue to impact our lives behind the scenes every day, and now these technologies are now becoming more apparent in our everyday lives. For the surface transportation system, these technologies may result in crash avoidance, reduced energy consumption, improved travel time reliability, multi-modal connectivity, and improved transportation system efficiency and accessibility for individuals with disabilities. Additional applications in robotics currently under research 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 mobility across the transportation network. Another emerging technology is collaborative robots that can work with individual travelers and human transportation services to provide concierge services at various stages of travel such as transit stations or on route

assistance and hence improve personal and independent mobility across the entire transportation network, including transportation terminals, home, work, and healthcare destinations.

Safe Intersection Crossing

A variety of intersection configurations with high traffic volumes and several conflict points can make it challenging for pedestrians to feel safe crossing a street, especially for those travelers with disabilities that may require assistance or additional time to safely navigate an intersection crossing. ATTRI seeks innovation in the area of intersection crossing to support an environment where all travelers, regardless of their physical and cognitive abilities, can safely and confidently cross any intersection irrespective of their disability type or need.

Safe navigation of crosswalks can be a key challenge for people who need more time to traverse an intersection. If there is no safe island zone mid-intersection then signal light duration becomes very important, for example. Within this application area, providing safe intersection crossing assistance for all unique travelers as they interface with existing traffic, signals, all types of vehicles and assistive devices are key focus areas. It is imperative, then, that technological solutions including design, focus on assistive tools for people with blindness, low vision, cognitive and mobility issues. Assistive tools may be in the form of personal nomadic devices, wearable technologies and kiosks on streets corners to allow for ubiquitous access to connected services.

Applications in this area should, for example, provide guidance, notifications and alerts in various communication formats that assist pedestrians and all users of the transportation system, navigate safely through intersections and focus of providing precise and concise information when it is needed and at the right moment to promote decision making and actions. These applications should address and could include, but are not limited to the following components: pedestrians interface with traffic signals, vehicles, nomadic devices, and automated intersection crossing assistance, beacons or electronic tags to interact with the built and pedestrian environment including support for multiple languages and sharing of real-time information. It should provide contextual information including GIS and crowdsourced based information on curb cuts, bus stop locations, side walk grade and slope, and any disruption of the built environment (damaged infrastructure, dead ends, potholed) to aid all travelers. Additional examples could include; futuristic and innovate approaches to solving this issue with automated intersection crossing assistance, technical design solutions for people with blindness, low vision, cognitive and mobility issues, or integrated beacons or electronic tags to interact with the built environment.

ATTRI Foundational Considerations

In addition, ATTRI determined four (4) foundational considerations that should be explored and considered for any application being developed under the ATTRI program. These foundational considerations are:

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 standardized data to create user profiles allowing smoother access and transferring between accessible transportation services.

Universal Design Standards and Information and Communications Technology (ICT)

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 ICT solutions. Implementation of such principles in development could include leveraging existing solutions and enhancing them to meet the needs of all users, as such user center and responsive design approaches, personalization techniques are expected to be followed for applications including implementing multiple communication formats (visual, audible,

haptic) where possible. Likewise, consideration should be given to incorporate user profiles and documented needs from all stakeholder and ability groups, and creating user experiences with information sharing on any display associated with such applications in built and pedestrian environments including wearable and nomadic devices.

Integrated Payment Systems

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.

Leverage Existing Technologies and Ongoing Research

To maximize the impacts of ATTRI and to respond most effectively to the needs of all users and stakeholders, any application being developed under ATTRI should leverage, to the degree possible, existing technologies, including but not limited to Intelligent Transportation Systems (ITS), Application Program Interface (API), Software Development Platform, Software Development Kit, on-demand technologies, data standards, innovative smartphone and mobile technology, wearable technology, accessible transportation technologies, and other assistive and enabling technologies, operations, and/or techniques whether currently being pursued in research, or readily available in the market.