



ACCESSIBLE TRANSPORTATION TECHNOLOGIES
RESEARCH INITIATIVE



U.S. Department of Transportation
Federal Transit Administration



U.S. Department of Transportation
Federal Highway Administration



Vision

*ATTRI seeks to remove barriers to transportation by leveraging advanced technology to enable people to travel **independently, anytime of the day to any destination**, regardless of their individual abilities.*

Mission

*To transform the mobility of travelers with disabilities by providing the capability to reliably, safely and independently plan and execute their travel **by leveraging principles of universal design and inclusive information and communication technology (ICT)**. ATTRI identifies, **collaborates**, coordinates, develops, and implements **transformative** solutions in advancing accessible transportation and **independent** mobility.*



The Challenge



Persons with Disabilities

- 56.7 million; 19% US population
- Unemployment Rate – 13.2 %; Income: \$38,400 (\$61,000)
- Poverty: 24.7% (9.0%)
- Rise in Autism: 1 in 150 (2000) to 1 in 68 (2010)
- Fed expenditures: \$226 B (2002); \$357 B (2008)



Veterans with Disabilities

- 21.4 million Americans are Veterans
- Disability claims: 104,819 (2006) vs. 634,743 (2012)
- 2.6 million deployed in 2012, 45% of eligible Veterans file claims for disability
- Spending: \$0.93 billion (2006) vs. \$5.95 billion (2012)



Older Adults

- Disability rates rise as people get older
- 43.1 million age 65 + in 2012 or 1 in 7 people
- 28% live alone
- Expected to reach 72.1 million by 2030

Challenges and Opportunities



- 76% people with disabilities say adequate transportation is important to their job search
- 29% consider it a significant problem in accessing jobs ^[1]

Targeted Populations



Persons with Disabilities



Veterans with Disabilities



Older Adults

Types of Disabilities



Vision



Mobility



Hearing



Cognitive

Enabling Technologies

**ITS,
Wireless
& Sensors**

**Connected
Vehicles**

**Automated
Vehicles/ Personal
Mobility**

**Robotics,
Artificial
Intelligence**

**Accessible
Data**

Technology Recommendations



Wayfinding & Navigation Solutions

- Focus on integration of map data and standardized infrastructure descriptions from various sources
- New data unique and specific to ATTRI users should be developed



ITS & Assistive Technologies

- Focus on remote assistance for stakeholders and opportunities to inform and aid barrier traversal
- Modernizing assistive technology maintenance and asset management (area for advanced research)



Automation & Robotics

- Shared neighborhood autonomous vehicles which are cost effective and aid at traversing distances between transit stops, homes, and places of employment.
- Assist service models, electric vehicles, and autonomous vehicles create opportunities for novel accessible designs



Data Integration

- Reduce complexity and identify coordination in service matchmaking through open data and services
- Develop environment for community generated data



Enhanced Human Services Transportation

- Support initiatives by ridersharing services to involve ATTRI stakeholders and develop accessible versions of these services.
- Support mode shift through private on-demand ride services



[Links to Final Reports](#)



U.S. Department of Transportation
Federal Highway Administration



U.S. Department of Transportation
Federal Transit Administration



U.S. Department of Transportation
Office of the Assistant Secretary for Research and Technology

Documenting User Needs



Top Identified Barriers

75

Lack of / or inaccessible signage/ maps/ landmark identifiers/ announcements

71

Navigation difficulties (do not know when arrive, transfer time, distance)

67

Inconsistent accessible pathway infrastructure

Top Identified User Needs

102

Amenity information (e.g. restroom, shelter)

88

Real-time transportation information

76

Safety, security and emergency information

Top Identified Issues with Technology

46%

Training to use and awareness of new technology

21%

Affordability

16%

Performance quality (especially long-distance travel, rural areas)



User Needs

**Final Report Available
on the ATTRI Website:**
http://www.its.dot.gov/research_h_archives/attri/index.htm



U.S. Department of Transportation
Federal Highway Administration



U.S. Department of Transportation
Federal Transit Administration



U.S. Department of Transportation
Office of the Assistant Secretary for Research and Technology

Application Priorities



Foundational Considerations

**Standard
Accessible
Data Platform**

**Universal
Design
Standards**

**Integrated
Payment**

**Leverage
Existing
Technologies**



Smart Wayfinding & Navigation Systems

- Wayfinding and navigation systems for indoor and outdoor use
- Wearable technologies
- Community navigators



Pre-Trip Concierge & Virtualization

- Pre-trip and in-route traveler information
- Connected travelers
- Virtual caregiver help for pre-trip planning and on route support



Robotics & Automation

- Assistive and collaborative robotics to enhance mobility
- Ability to plan and execute trips, associated services
- Transformative transportation alternatives



Safe Intersection Crossing

- Intersection crossing assistance for all travelers
- Pedestrians interface with traffic signals, vehicles and nomadic devices
- Guidance, notifications and alerts for optimization

ATTRI Complete Trip



ATTRI - THE COMPLETE TRIP

After his doctor's appointment, Andy decides to take a spontaneous trip to meet a friend at a coffee shop in an unfamiliar part of town. Using ATTRI's **pre-trip concierge**, **wayfinding and navigation**, **robotics and automation**, and **safe intersection crossing** applications, Andy can travel with confidence throughout his trip.

5. Arrival at Destination

Andy safely arrives at his destination, while the **pre-trip concierge application** plans his return trip home.



1. Plan and Book a Trip

Andy uses a **pre-trip concierge application** to plan and book his trip from the doctor's office to the coffee shop.



2. Travel to Transit Station

An **automated shuttle** (rideshare service) is dispatched to take Andy to the transit station based on his booked trip. Once there, an **assistive robot** helps Andy to his bus platform.



3. Ride the Bus

While on the bus, Andy receives direction on when to pull the Stop Request cord from his **wayfinding and navigation application**. After he departs the bus, the application provides Andy with turn-by-turn walking directions to the coffee shop.



4. Cross the Street

As Andy approaches an intersection, his **safe intersection crossing application** communicates with the traffic signal to ensure sufficient time for him to safely cross the street, and notifies him when it is safe to begin crossing. The application also communicates with nearby cars to notify them of Andy's presence in the intersection.



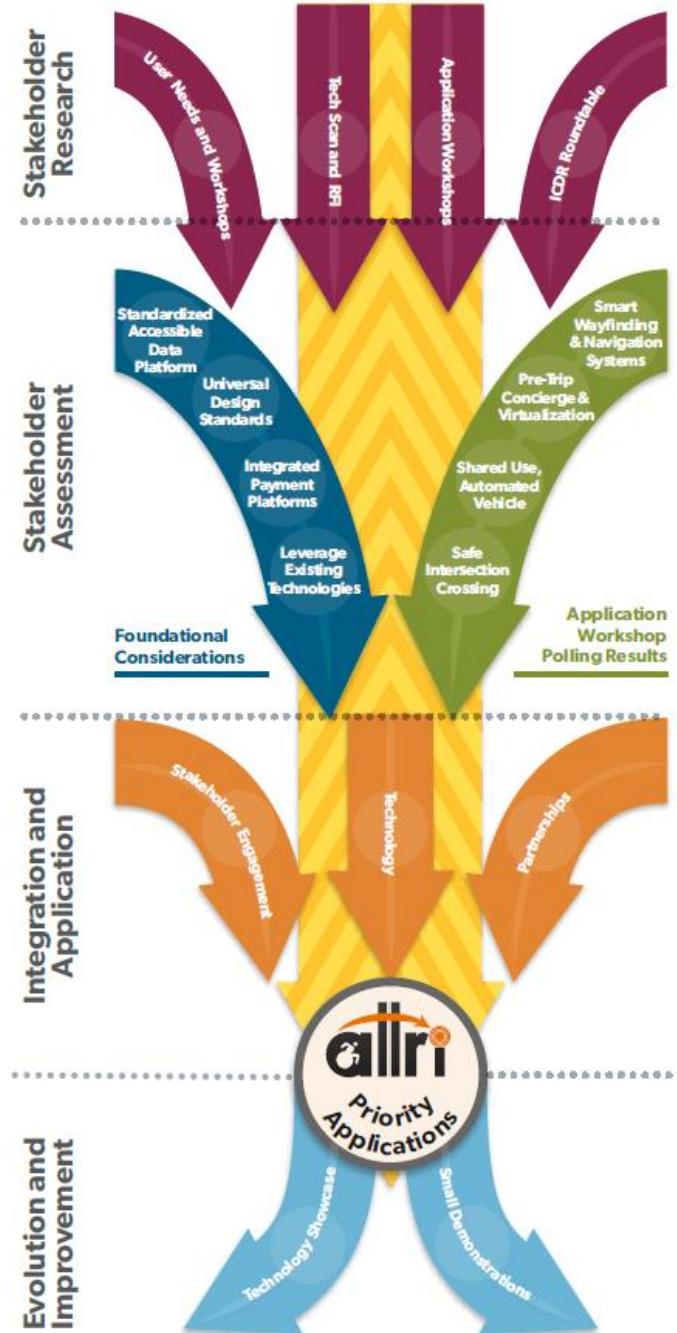
Application Development

- Stakeholder Engagement and User Needs Assessment
- Technology State of Practice and Innovation Scan
- ICDR Roundtable
- RFI
- Applications Workshop

- Foundational Considerations
- Priority Application Areas
- Partnerships
- USDOT BAA & NIDILRR FOA

- Application Development
- Prototyping & Testing
- Technology Showcases and Demonstrations

Searching for ATTRI Applications



Broad Agency Announcement (BAA)



The objective of ATTRI BAA is to put contracts in place that will:

- Develop applications in three of the ATTRI priority application areas:
 - Aimed to advance the current knowledge and state-of-the-art in the sciences and technologies employed in the planning, design, construction, operation, maintenance and management of accessible transportation
 - Application development will include prototyping, demonstration and evaluation
- Collaborate with other application development areas under the ATTRI program

Acquisition Approach



- USDOT BAA:
 - Application development for:
 - Wayfinding and Navigation,
 - Pre-Trip Concierge and Virtualization, and
 - Safe Intersection Crossing
- NIDILRR/HHS FOA
 - Application Development for:
 - Robotics and Automation for Accessible Transportation

Prototype Awards



Application Area	Contractors	Description
Pre-Trip Concierge and Virtualization	AbleLink	Create a suite of assessment, self-directed learning, and trip execution technologies to support pre-trip planning needs
Wayfinding & Navigation	AbleLink	Open wayfinding media standard and the infrastructure for creation of geographically specific cloud-based libraries of routes
Wayfinding & Navigation	City College of New York	Smart Cane for Assistive Navigation (SCAN) integrated with a Smart Phone application
Wayfinding & Navigation	Pathway Accessibility Solutions, Inc.	Wayfinding tool for wheelchair users and people with visual impairment, providing routes tailored to the preferences of the user.
Wayfinding & Navigation	TRX	Smart Wayfinding and Navigation system to obtain real-time location, en-route assistance and situational awareness
Safe Intersection Crossing	Carnegie Mellon University	Connect pedestrian travelers with disabilities to the traffic signal infrastructure to develop assistive services for safe intersection crossing and increased traveler mobility.



ACCESSIBLE TRANSPORTATION TECHNOLOGIES
RESEARCH INITIATIVE

Application Development Projects:



AbleLink #1 SMART Wayfinding Standard



U.S. Department of Transportation
Federal Transit Administration



U.S. Department of Transportation
Federal Highway Administration



U.S. Department of Transportation
Office of the Assistant Secretary for Research and Technology

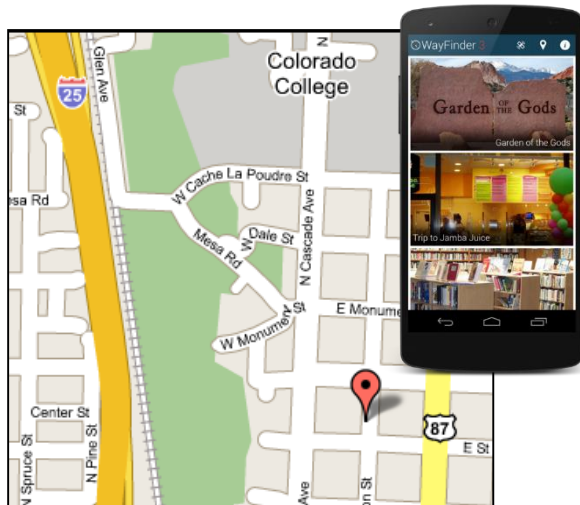


SMART Wayfinding Standards



Independent Travel Support Technologies for Individuals with Cognitive Disabilities

- **Project Objective:** Develop a common route format for presenting travel instructions to individuals with cognitive disabilities to allow users of these wayfinding technologies to access and share routes that enable them to use public transit more independently.



Partnerships



AbleLink Smart Living Technologies is the prime contractor for the SMART Wayfinding Standard project with support from:

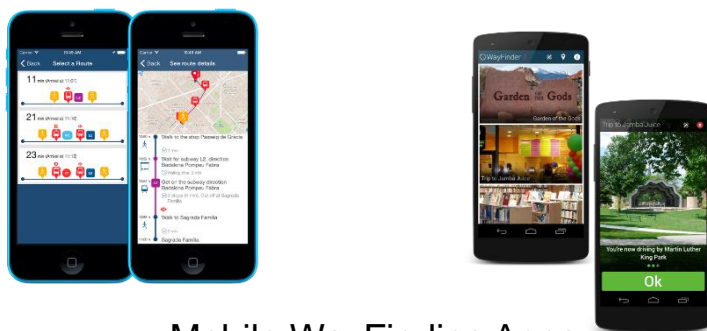
- *The ARC of Albuquerque (ARCA) -- participating as a project partner to support system development and pilot testing*
- *Ability Beyond, serving individuals with disabilities in Connecticut and New York -- will also support system development activities and pilot testing*
- *Project Steering Committee – Composed of 25 stakeholders from around the country with a keen interest in enhancing independent transportation options for individuals with cognitive disabilities*



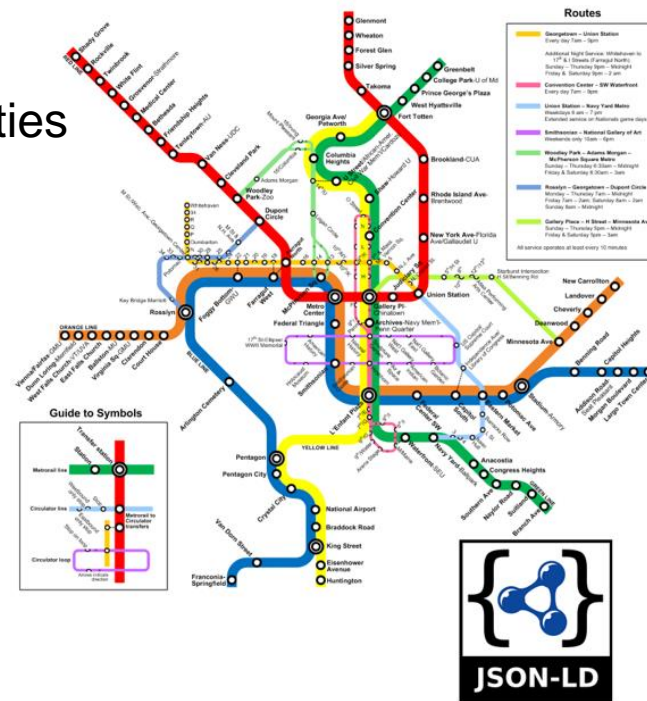
Innovative Claims



- In this Project we will identify and develop the Specialized Media for Assisting Route Travel (*SMART*) Wayfinding Standard to facilitate independent use of public transportation by individuals with cognitive disabilities
- This new “defacto” industry standard will encourage new wayfinding technologies to be developed for individuals with cognitive disabilities and others with special needs



Mobile WayFinding Apps



- Cloud-based tools will further promote the use of the new standard by simplifying creation of new routes and allowing users greater access to *SMART* compliant routes in their region



1) TRAVEL MANAGER – a web-based tool for simplifying the ability to create *SMART* compliant travel routes for various destinations

- Cloud-based tools will further promote the use of the new standard by simplifying creation of new routes and allowing users greater access to *SMART* compliant routes in their region

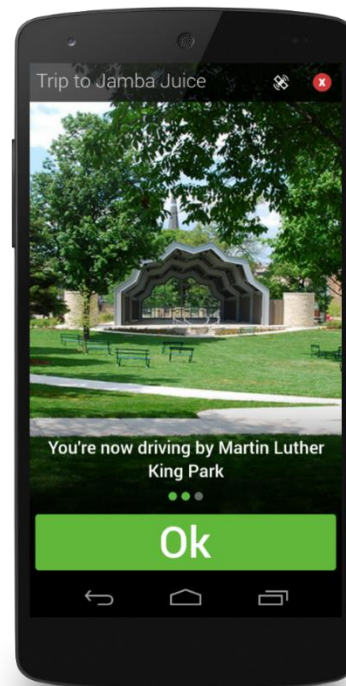
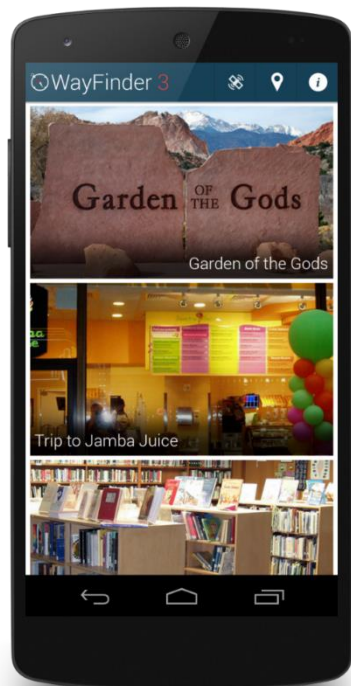


2) *SMART Travel Library* – *a cloud-based library of routes to specific destinations that will provide easy access to SMART compliant routes for specific geographic areas which can be downloaded and used as is or modified to meet the needs of travelers with cognitive disabilities and others with special needs*

Innovative Claims



- The first *SMART* compliant mobile app will be developed based on AbleLink's WayFinder system, which will support the *SMART* Wayfinding Standard and interface with the new cloud-based route library



Technical Approach and Rationale



- *In summary – the following tools will be developed in this project to facilitate adoption and use of the SMART Wayfinding Standard, including:*
 - **TRAVEL MANAGER** – *a web-based tool for simplifying the ability to create SMART compliant travel routes for various destinations*
 - **SMART Travel Library** – *a cloud-based library of routes to specific destinations that will provide easy access to SMART compliant routes for specific geographic areas which can be downloaded and used as is or modified to meet the needs of travelers with cognitive disabilities*
 - **WayFinder Mobile App** – *a mobile app that will utilize SMART compliant routes for desired destinations to provide geo-location based multimedia instructions to individuals with cognitive disabilities to facilitate independent travel*
- *Together, these tools will advance ATTRI objectives by providing innovative wayfinding technologies for helping individuals with cognitive disabilities to independently use the fixed route transit system and move away from more costly specialized travel services such as paratransit*

Expected Impacts



- We expect to see a 50% increase in use of fixed-route services by individuals with cognitive disabilities
- We expect to see a 25% decrease in traditional paratransit services for individuals with cognitive disabilities.
- Satisfaction surveys of travelers with cognitive disabilities and their support network will report increased ease of use of the transportation system.
- Transit agencies will experience reduced costs for providing paratransit services and increased ridership for customers with cognitive disabilities.

References

Stock, S.E., Davies, D.K., Hoelzel, L.A. and Mullen, R.J. (2013). *Evaluation of a GPS-Based System for Supporting Independent Use of Public Transportation by Adults with Intellectual Disability, Inclusion*, Vol. 1, No. 2, pp. 133-144.

Stock, S.E., Davies, D.K., Wehmeyer, M.L. and Lachapelle, Y. (2011). *Emerging new practices in technology to support independent community access for people with intellectual and cognitive disabilities*, *NeuroRehabilitation*, Vol. 28, No. 3, p. 167-308; May, 2011.

Mullen, R.J. and Hoelzel, L.A. (2012). *SMART Travel Program: Using Smart Phones and WayFinder to Increase Independent Mobility of Adults with Developmental Disabilities*, *The ARC of Albuquerque (ARCA) White Paper*, July 24, 2012.

Davies, D.K., Stock, S.E., Holloway, S. and Wehmeyer, M.L. (2010). *Evaluating a Cognitively Accessible GPS-Based Transportation Assistance PDA to Enable Independent Bus Travel for People with Intellectual Disability*, *Intellectual and Developmental Disabilities*; Vol. 48, No. 6, pp 454-463.

Outreach Activity to Date



- AbleLink has presented on this ATTRI Research project at the State of Tennessee's Technology Summit Sponsored by the Tennessee Department of Intellectual and Developmental Disabilities in Nashville TN, August 2017
- AbleLink has presented on this project to families, individuals with intellectual disabilities and staff of Rocky Mountain Human Services at a series of sessions from August to October, 2017
- AbleLink presented on this project at the 2017 Coleman Institute Conference on Cognitive Disability and Technology in Denver Colorado, November 2017
- AbleLink communicates updates on this project on their social media channels, including Twitter, Facebook and targeted email communication

Additional Information



- Video from Previous WayFinder research
“Riding the Bus Independently Using AbleLink’s WayFinder”
<https://www.youtube.com/watch?v=iNYfFpzjqyU>
- Video summarizing the ARC of Albuquerque’s Smart Travel Program
ARCA’s Smart Travel Program Featuring WayFinder
“Riding the Bus Independently Using AbleLink’s WayFinder”
<https://www.youtube.com/watch?v=YShStpwD9j0>
- For additional information on Cognitive Support Technologies, visit AbleLink Smart Living Technologies at:
<http://www.ablelinktech.com>

Questions?



Mohammed Yousuf

ATTRI Program Manager
Federal Highway Administration

Mohammed.Yousuf@dot.gov

Bob Sheehan

Multimodal Program Manager
ITS Joint Program Office

Robert.Sheehan@dot.gov

Rik Opstelten

Mobility Innovation Program Analyst
Federal Transit Administration

Hendrik.Opstelten@dot.gov

Murat Omay

Senior Transportation Program Analyst
Federal Transit Administration

Murat.Omay@dot.gov



ACCESSIBLE TRANSPORTATION TECHNOLOGIES
RESEARCH INITIATIVE

pathVu

Application Development Projects:

AccessPath: A pedestrian wayfinding tool tailored towards wheelchair users and individuals with visual impairments



U.S. Department of Transportation
Federal Transit Administration



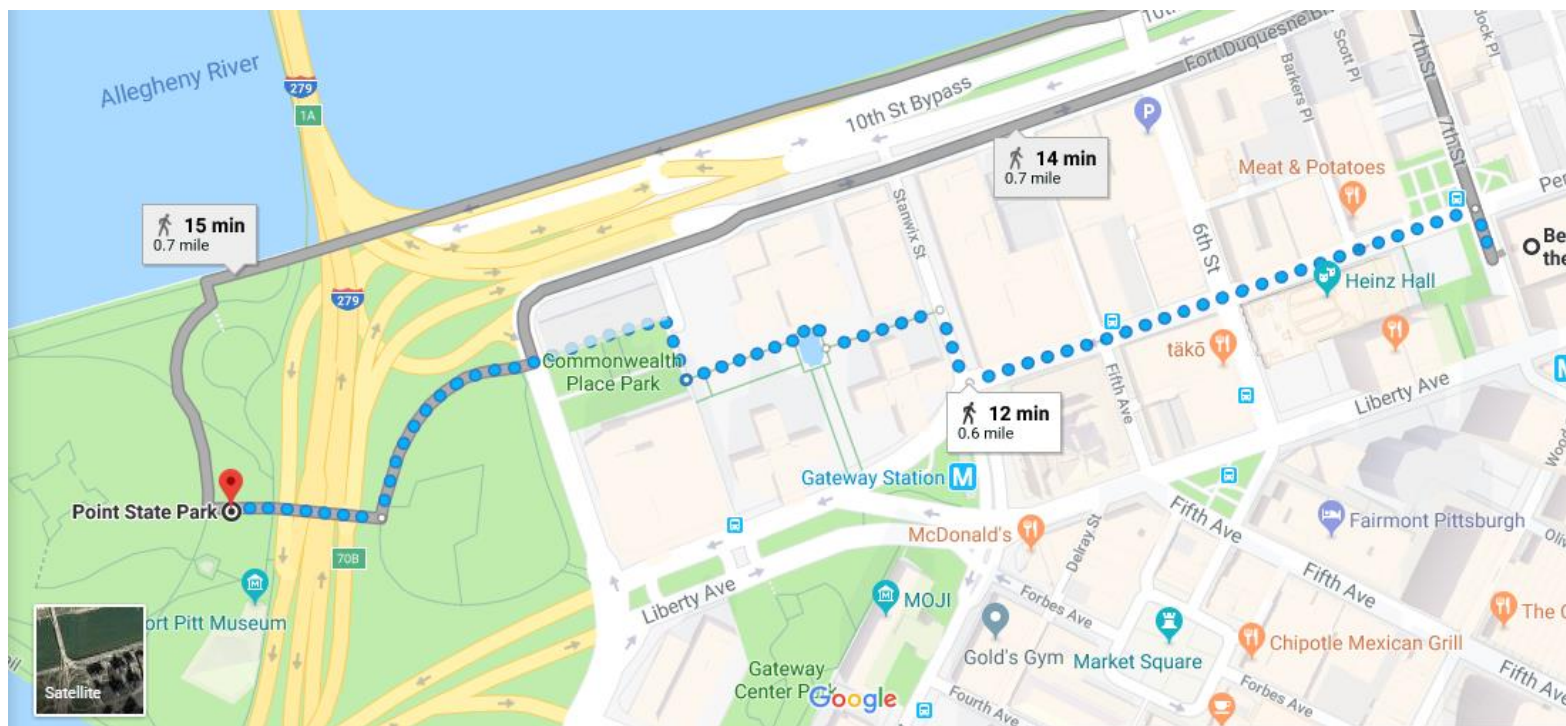
U.S. Department of Transportation
Federal Highway Administration



U.S. Department of Transportation
Office of the Assistant Secretary for Research and Technology



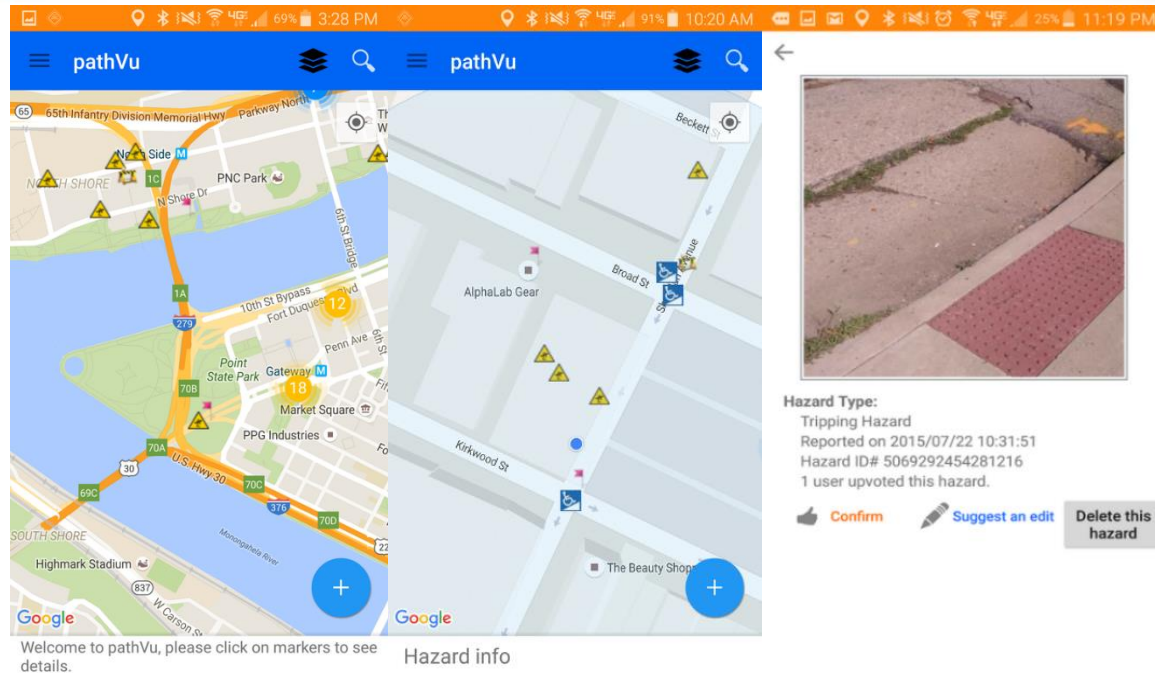
Google Maps route



- Tripping Hazards
- Roughness
- Running Slope
- Cross Slope
- Depressions
- Width
- Images



pathVu Crowdsourcing App

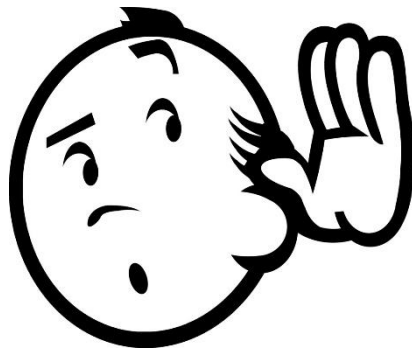


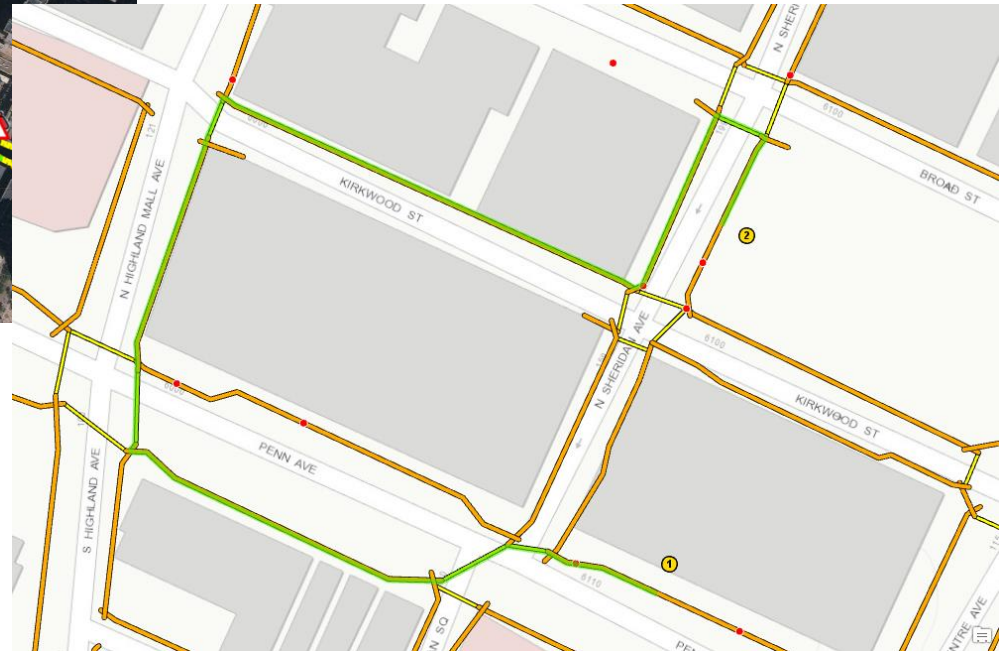
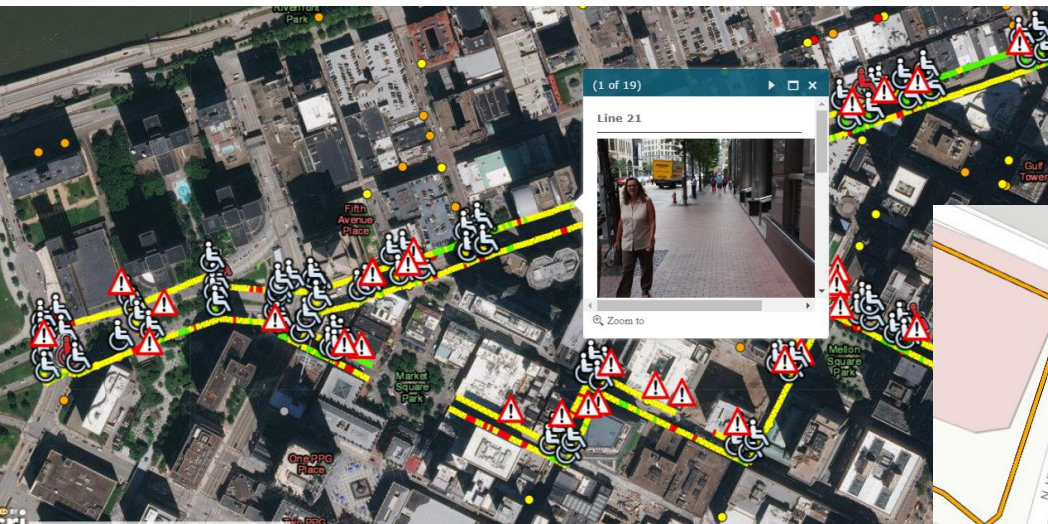
- Location
- Type
- Quality
- Image

What We've Heard



- Accuracy is key
- Customizable
- Real-time
- Simple
- Accessibility
- Reduce cognitive load
- Orientation
- Data from PathMeT
- Preferences and Settings
- App calls server
- User interviews
- Integrate with app accessibility
- Pre-trip planning and alerts
- Orientation button





Sample map of data and points of interest used in AccessPath wayfinding

Features



- Real-time step-by-step directions
 - Sidewalk location
 - Curb ramps
 - Intersections
 - Passable/Unpassable
- Pre-trip planning
- Three route options
- Preferences/Settings
 - Custom
 - Default
 - Preset
- Route around obstacles
- Points of Interest/Address search
- Audible and visual navigations
- Audible/Visual alerts
- Submit reports
- Siri/Voice assistant
- Voice over
- Repeat directions
- Orientation

Partnerships



- pathVu, a small business in Pittsburgh, PA, is leading the project. The development of the AccessPath app will be done primarily by pathVu and its employees.
- pathVu partnered with the University of Pittsburgh to design the Geographic Information Systems (GIS) database and to advise on best methods for pedestrian navigation.
- Fine Humans, a small business in Pittsburgh, PA, will assist with the AccessPath app interface for visual and non-visual users.
- pathVu will consult with CivicMapper for assistance with other mapping and GIS needs.



Innovative Claims



- Pedestrian wayfinding algorithms using a connected network of sidewalks, pathways, and crosswalks only.
- Pedestrian wayfinding algorithms that integrate pathway quality, and a user interface tailored towards wheelchair users, customized based on a user's preferences.
- Pedestrian wayfinding algorithms that integrate pathway quality, and user interface tailored towards people who are blind or visually impaired, customized based on preferences.
- Downloadable iOS and Android mobile apps that integrate the AccessPath algorithms and provide pedestrian wayfinding for wheelchair users and people with visual impairments.

Technical Approach and Rationale



- AccessPath will improve accessibility and walkability for, and safety of pedestrians.
- AccessPath will utilize high-fidelity data collected with pathVu's PathMeT, a manually propelled device that characterizes conditions along pathways such as tripping hazards, running slope, cross slope, and roughness.
- AccessPath will integrate published research by the University of Pittsburgh that focuses on pedestrian navigation for people with disabilities.
- AccessPath will utilize ArcGIS as the platform for its GIS maps and wayfinding.

Expected Impacts



- pathVu expects that users will prefer AccessPath wayfinding over typical pedestrian wayfinding apps.
- pathVu expects to see 500 downloads in the first three months of launch.
- pathVu expects to see adoption of the AccessPath app by the City of Pittsburgh, the original test site.
- Pedestrians will be able to travel more accessibly and independently

Outreach Activity



- pathVu plans to do a launch of AccessPath for the ADA Symposium in Pittsburgh in Summer 2018.
- pathVu plans to partner with cities, engineering companies, and disability advocates to bring AccessPath to other cities

Moving forward



- More data
 - Curb ramp details
 - Pedestrian signal
 - Destination accessibility
 - Construction
- Accommodate cognitive disabilities
- Additional features
 - What is around me?
- Phase 2
 - Eight additional cities
- Long term
 - Every major city
 - Integrate with major mapping companies (i.e. Google, Apple)



Additional Information



- Nick Sinagra, software developer and wheelchair user, is designing the AccessPath apps.
- Soft launch of AccessPath in Pittsburgh expected in Spring 2018.
- pathVu's goal is for AccessPath to be implemented in every major city around the country, and ultimately, throughout-the world.

Questions?



Mohammed Yousuf

ATTRI Program Manager
Federal Highway Administration

Mohammed.Yousuf@dot.gov

Bob Sheehan

Multimodal Program Manager
ITS Joint Program Office

Robert.Sheehan@dot.gov

Eric Sinagra

CEO

pathVu

Eric.Sinagra@pathVu.com

Rik Opstelten

Mobility Innovation Program Analyst
Federal Transit Administration

Hendrik.Opstelten@dot.gov

Murat Omay

Senior Transportation Program Analyst
Federal Transit Administration

Murat.Omay@dot.gov