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ACCESSIBLE TRANSPORTATION TECHNOLOGIES
RESEARCH INITIATIVE

U.S. Department of Transportation
Federal Transit Administration

U.S. Department of Transportation
Federal Highway Administration

U.S. Department of Transportation
Office of the Secretary of Transportation

The Situation

Persons with Disabilities

- 19% US population
- Unemployment Rate – 10.5%; Income: $22,047 (2016)
- Poverty: 24.7% (9.0%)
- Rise in Autism: 1 in 150 (2000) to 1 in 68 (2010)
- Fed expenditures: $226 billion (2002); $357 billion (2008)

Veterans with Disabilities

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

Older Adults

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

Diverse Population of People with Disabilities with Varying Needs

Is Lack of Adequate Transportation a Problem?

2x

say it is important to their daily living needs

76%

say it is important to their job search

29%

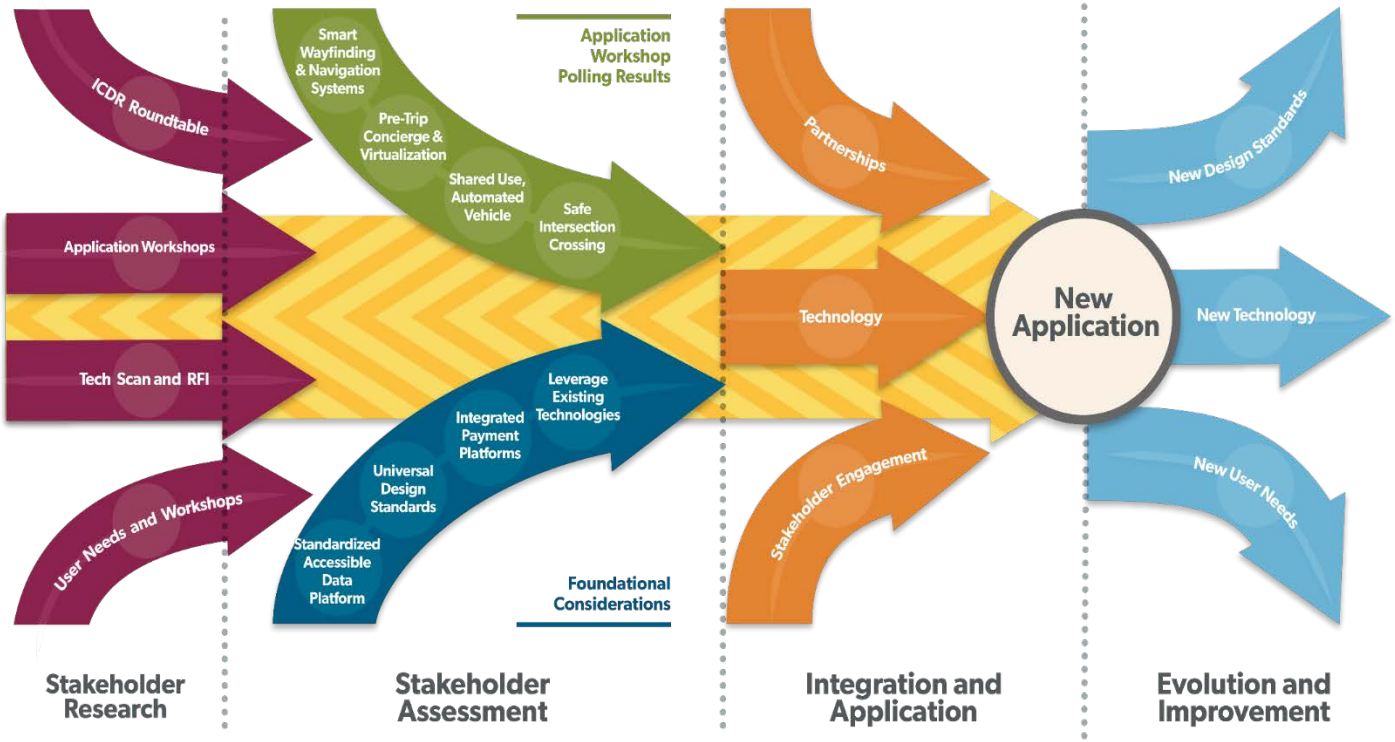
consider it a significant problem in accessing jobs

"The Role of Public Transportation as a Job Access Mode: Lessons from a Survey of Persons with Disabilities in New Jersey", Rutgers The State University of New Jersey, 2011

ATTRI Vision

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

User Driven Development



Application Priorities & Consideration

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 an on route support

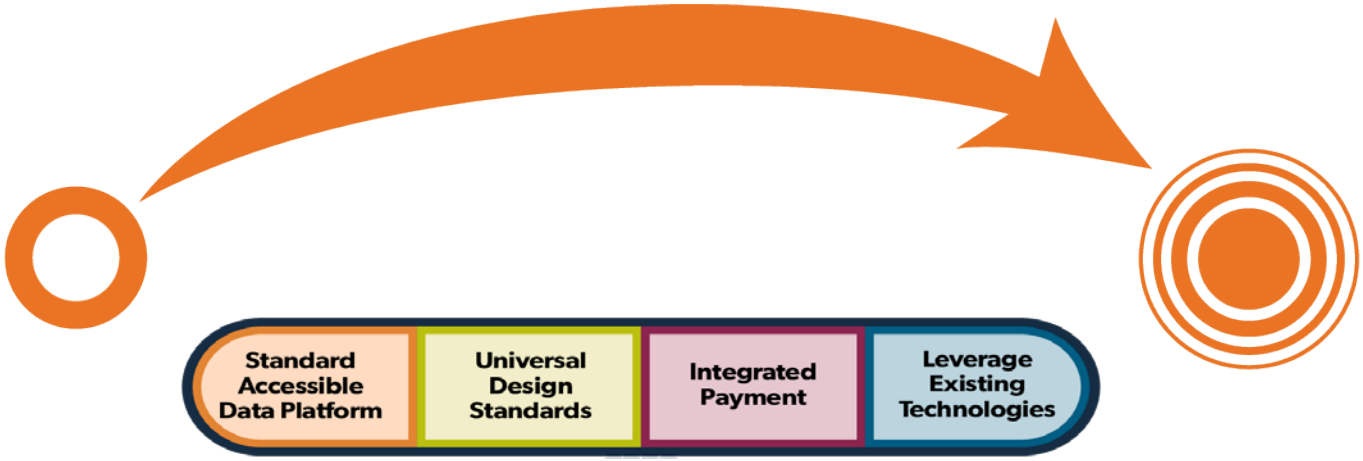
Robotics & Automation

- 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

Complete Trip & ATTRI Applications



Smart Wayfinding & Navigation

Pre-Trip Concierge & Virtualization

Robotics & Automation

Safe Intersection Crossing

ATTRI Application Development Awards

Wayfinding and Navigation:

CITY COLLEGE OF NEW YORK

Smart Cane for Assistive Navigation (SCAN), a wayfinding solution for those with low vision integrated with a smart phone application

ABLELINK

An open wayfinding media standard and related infrastructure to create geographically-specific, cloud-based libraries of routes in metropolitan or rural areas

PATHWAYS SOLUTIONS

A wayfinding tool for wheelchair users and people with visual impairment that guides users along routes tailored to their preferences

TRX SYSTEMS

A smart wayfinding and navigation system to obtain real-time location, en-route assistance, and situational awareness.

ATTRI Application Development Awards (cont.)

Pre-Trip Concierge and Virtualization:

ABLELINK

A suite of assessment, self-directed learning, and trip execution technologies to support pre-trip planning for individuals with cognitive disabilities.

Safe Intersection Crossing:

CARNEGIE MELLON UNIVERSITY

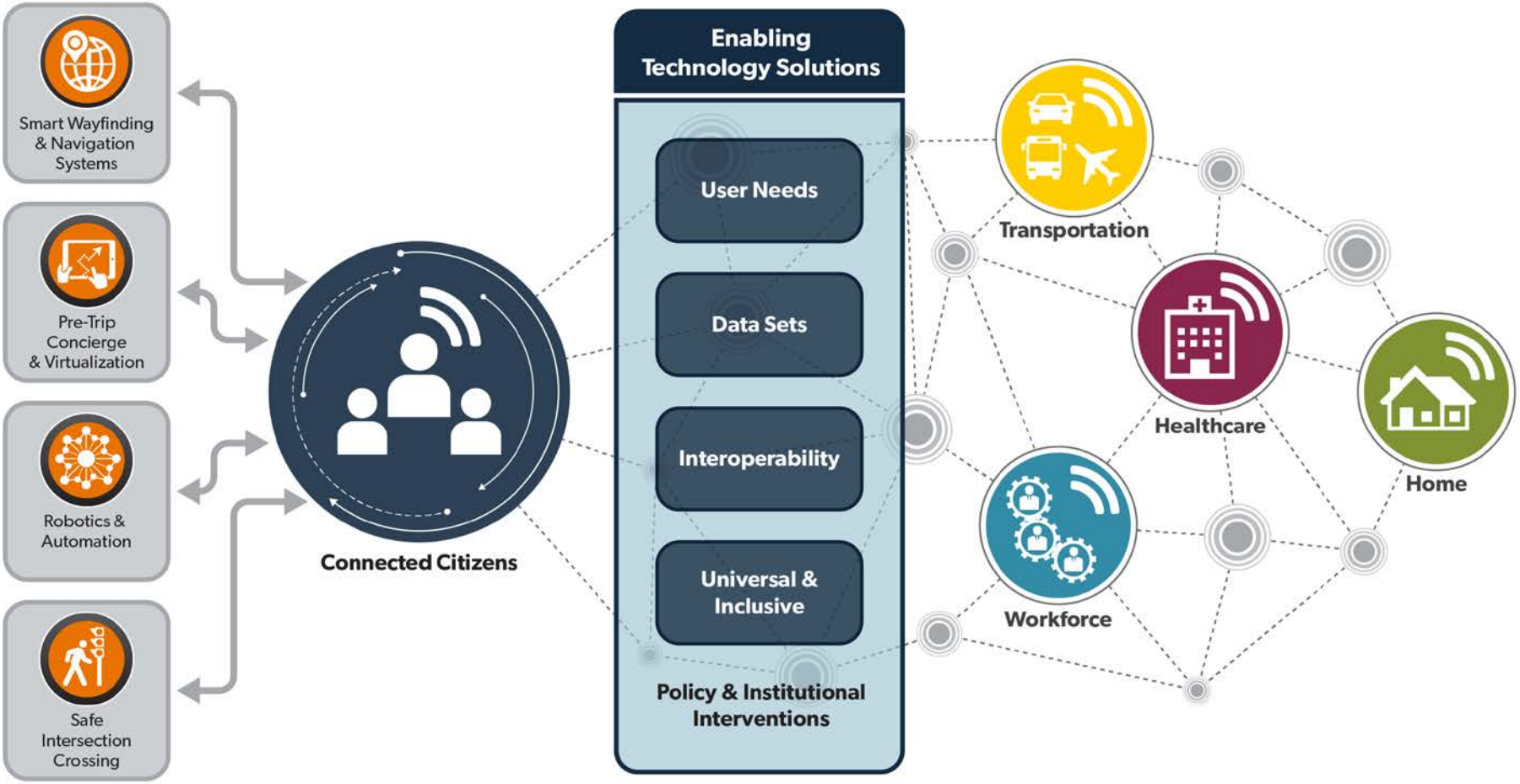
A tool to connect pedestrians with disabilities to the traffic signal systems infrastructure (and nearby connected vehicles and infrastructure) and create situational awareness to improve the safety of intersection crossing and increase independent mobility.

Robotics and Automation:

CARNEGIE MELLON UNIVERSITY

Awarded by the National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILLR) this project researches and develops seamless transportation assistance from cloud-based autonomy and shared robots located in and around transportation hubs.

ATTRI and Other Possibilities



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ATTRI Website:
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Ken Wood

NIDILRR

Program Specialist and Manager,
Switzer Research Fellowship Program

NIDILRR's Mission

National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR)

- NIDILRR is a disability and rehabilitation research agency in the Administration for Community Living (ACL)

- NIDILRR's mission:

To generate new knowledge and to promote its effective use to improve the abilities of individuals with disabilities to perform activities of their choice in the community, and to expand society's capacity to provide full opportunities and accommodations for its citizens with disabilities.

Disability and Rehabilitation Research Projects (DRRP) Program

- DRRP funds are used for research and development, knowledge translation, building capacity for minority research entities, individual research projects, and other work.

- DRRP projects carry out one or more of the following activities:
  - Research
  - Development
  - Demonstration
  - Training
  - Dissemination
  - Utilization
  - Technical Assistance

- Project Awards range from 3 to 5 five years.

For more information, visit: https://www.acl.gov/programs/research-and-development/disability-and-rehabilitation-research

ATTRI/NIDILRR Partnership

- NIDILRR partnered with USDOT's ATTRI program.
- NIDILRR's support of the ATTRI program:
  - ATTRI State of Practice and Innovation Scan
  - ATTRI International Coordination Scan
  - ATTRI grant in Robotics and Automation

NATIONAL INSTITUTE ON DISABILITY, INDEPENDENT LIVING, AND REHABILITATION RESEARCH

NIDILRR

ACCESSIBLE TRANSPORTATION TECHNOLOGIES RESEARCH INITIATIVE

Carnegie Mellon University

UNIVERSITY of WASHINGTON

DRRP ON ROBOTICS AND AUTOMATION FOR INCLUSIVE TRANSPORTATION

2017 ATTRI Application Development Awardee, funded by NIDILRR

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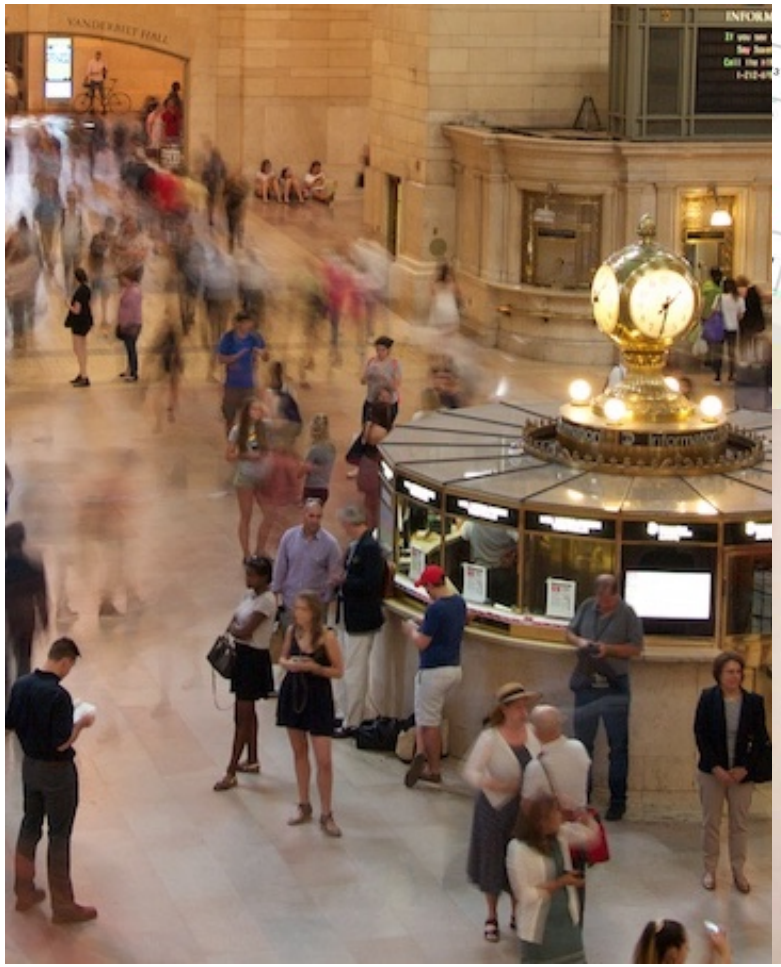
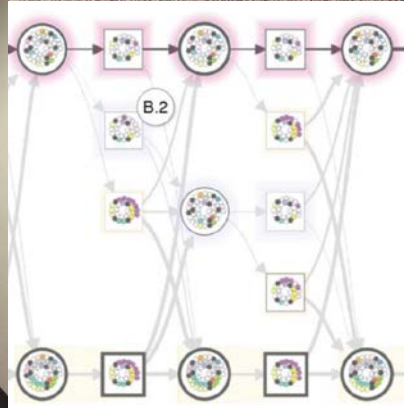
Transportation Hubs





Partnerships

- Carnegie Mellon University
  - With involvement by University of Washington
- Participation by Booz Allen Hamilton, Diyunu Consulting, and IBM Research – Tokyo
- Significant stakeholder involvement
  - **Government:** City of Pittsburgh, Port Authority of Allegheny County (PAAC), and US Army Research Laboratory (ARL) & US Army Tank Automotive Research Development and Engineering Center (TARDEC)
  - **Disability:** The Arc of Greater Pittsburgh (ACHIEVA), and Blind & Vision Rehabilitation Services of Pittsburgh (BVRS)
  - **Industry:** Sphero & Tiramisu Transit

Innovative Claims

- Support independent travel through **transportation hubs** with **cloud-based autonomy** and **shared helper robots**
- Dual-use technologies for robots and smartphones
  - Awareness of travel routines for tailored assistance
  - Preemptive, timely information
  - Labeled environment maps using computer vision and crowdsourcing
  - Assistance in hubs and rider-service rendezvous
- Public deployment in Pittsburgh (Y4-5)

Technical Approach and Rationale

- R1: Recognizing Travel Routines
  - Mankoff, Dey, Zimmerman
  - Human behavior research (NSF, NSERC)

- R2: Forward Assistance
  - Zimmerman, Bigham, Steinfeld
  - RERC-APT & Tiramisu (NIDILRR, US DOT, Traffic21)

- DV1: Characterizing Pedestrian Environments
  - Kitani, Bigham, Asakawa
  - NavCog/VizMap (IBM, Shimzu, etc)

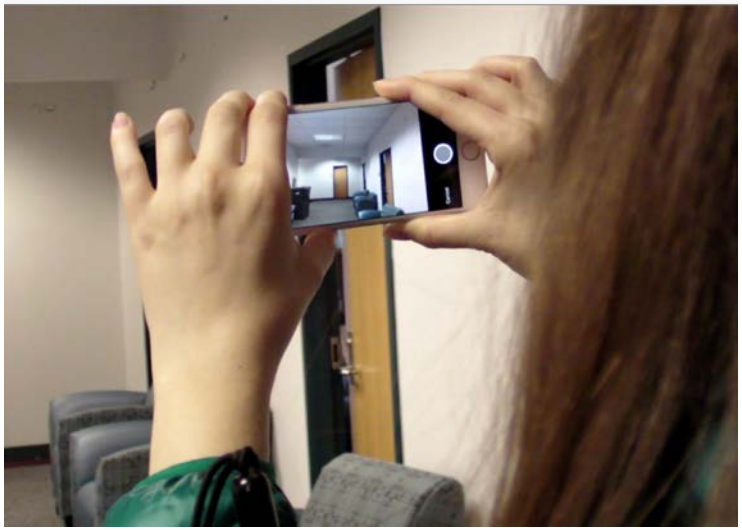
- DV2: Transportation Hub Assistance
  - Steinfeld
  - Assistive Robots for Blind Travelers (NSF, Traffic21)

Expected Impacts

- Open source software useful for a wide range of transportation applications
  - Extensions to NavCog, VizMap, and robot guide software
- New ways of detecting and tracking routine behaviors
- New knowledge on how technology should provide real-time assistance in transportation hubs
- Greater independence when moving through transportation hubs

Outreach Activity

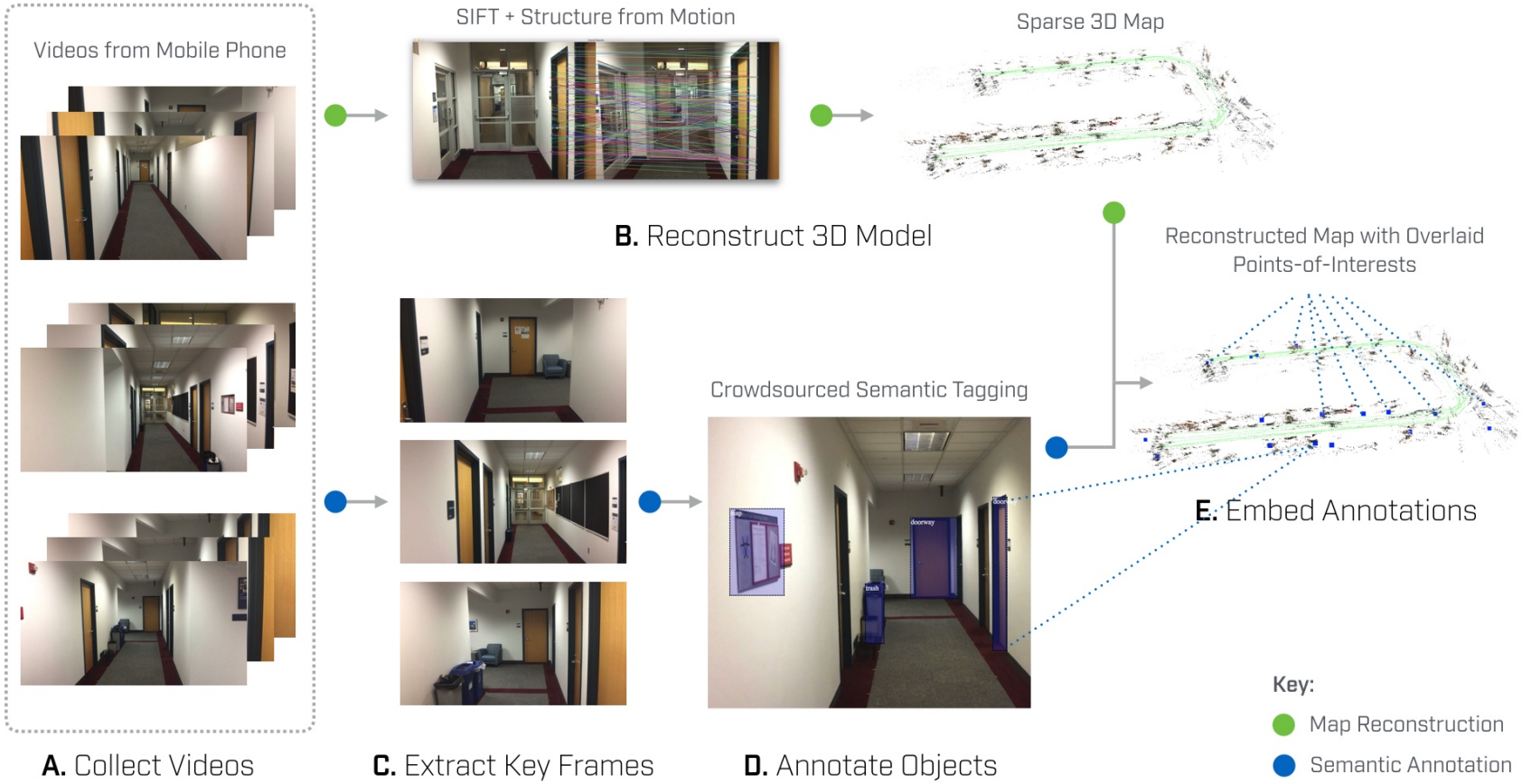
- Developing and testing systems in the real world with real users
- Frequent outreach efforts across a wide range of populations
- Multiple research publications and presentations on component and system level findings
- Students learning cutting edge technologies and the needs of people with disabilities



VizMap in use

Example:
Acquiring Map Knowledge

Project DV1: Kitani, Bigham, Asakawa, et al



Thanks

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