

ASSISTIVE ROBOTS FOR BLIND TRAVELERS

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OBJECTIVE

Human-robot interaction for robots assisting blind travelers navigate unfamiliar urban and built environments

Enable robots and blind travelers to interact in meaningful ways to enhance the safety and independence of urban navigation for all



RESEARCH APPROACH

Explores three principal research areas in the context of assistive robots for blind travelers:

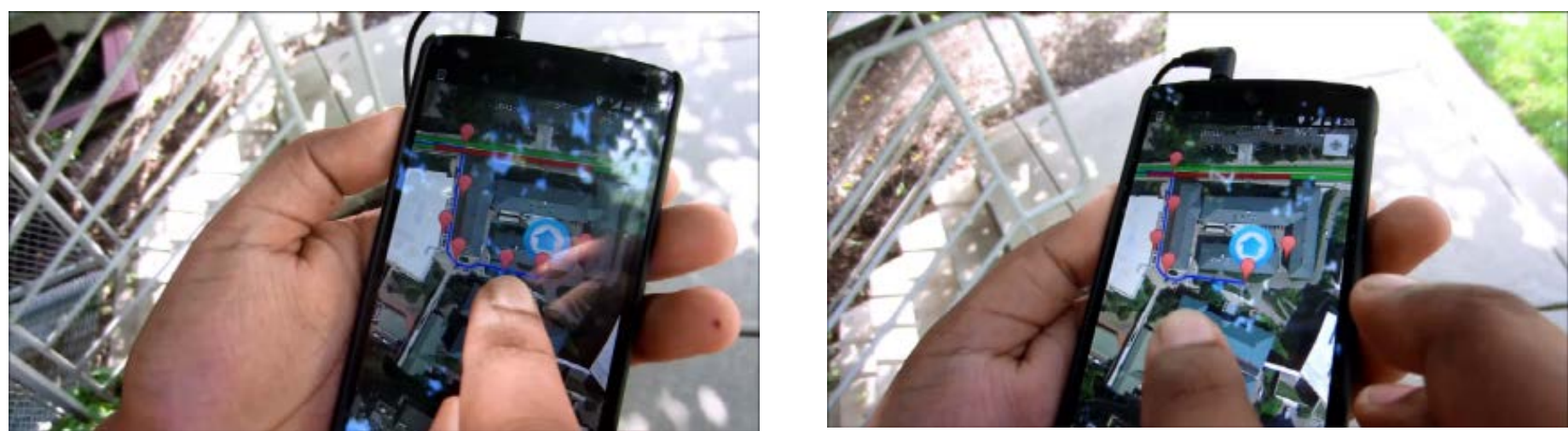
- 1) Accessible interfaces for assistive robots
- 2) Assistive interaction between humans and robots
- 3) Effective cooperation between a variety of human-robot and robot teams

The three principal research areas are applied to three scenarios:

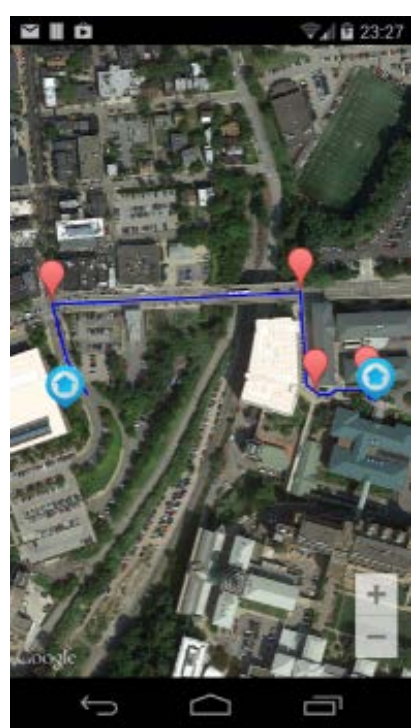
- 1) Information exchange and object manipulation
- 2) Urban navigation
- 3) Assistive localization

URBAN NAVIGATION

- Apps can provide navigation guidance in unfamiliar environments
- Usability Study: Aug. 2014
- Goal: Determine which on-screen gestures are more effective for the NavPal outdoor app and evaluate overall accessibility
- Participants: 4 visually impaired
- Techniques: in-person test



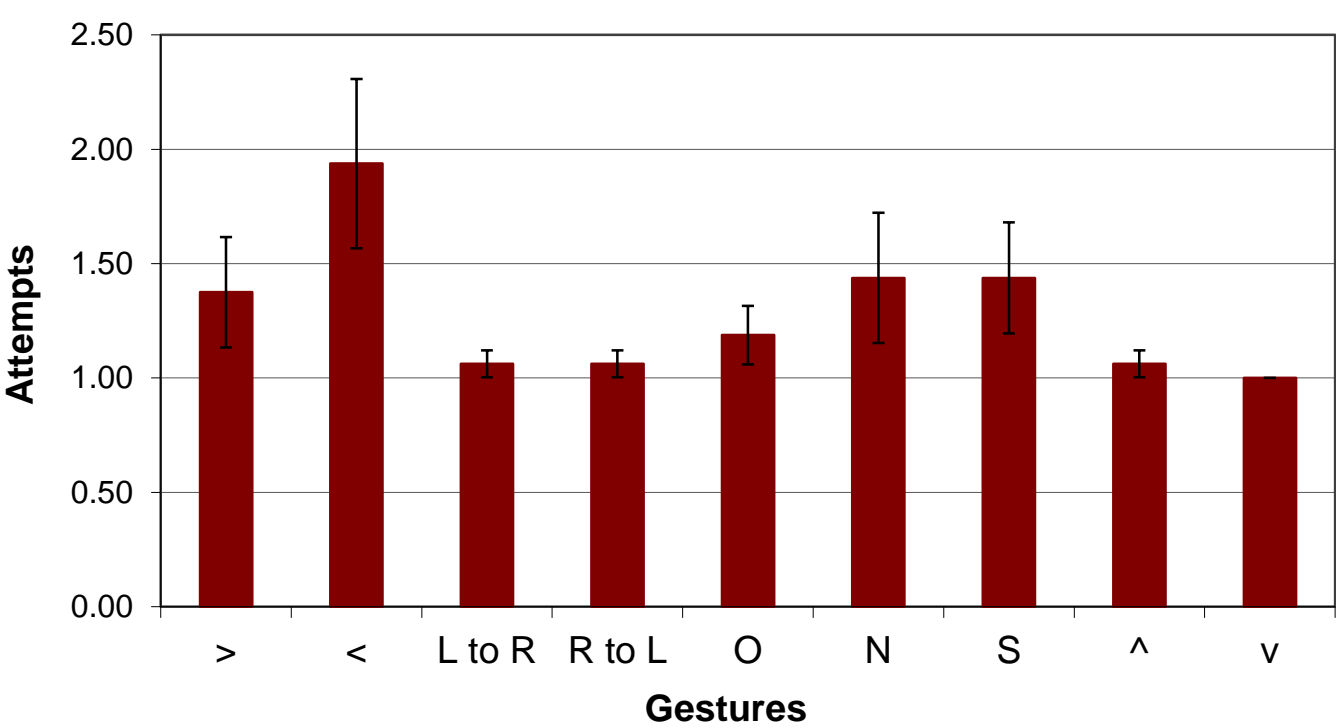
Demonstration of Breadcrumb approach



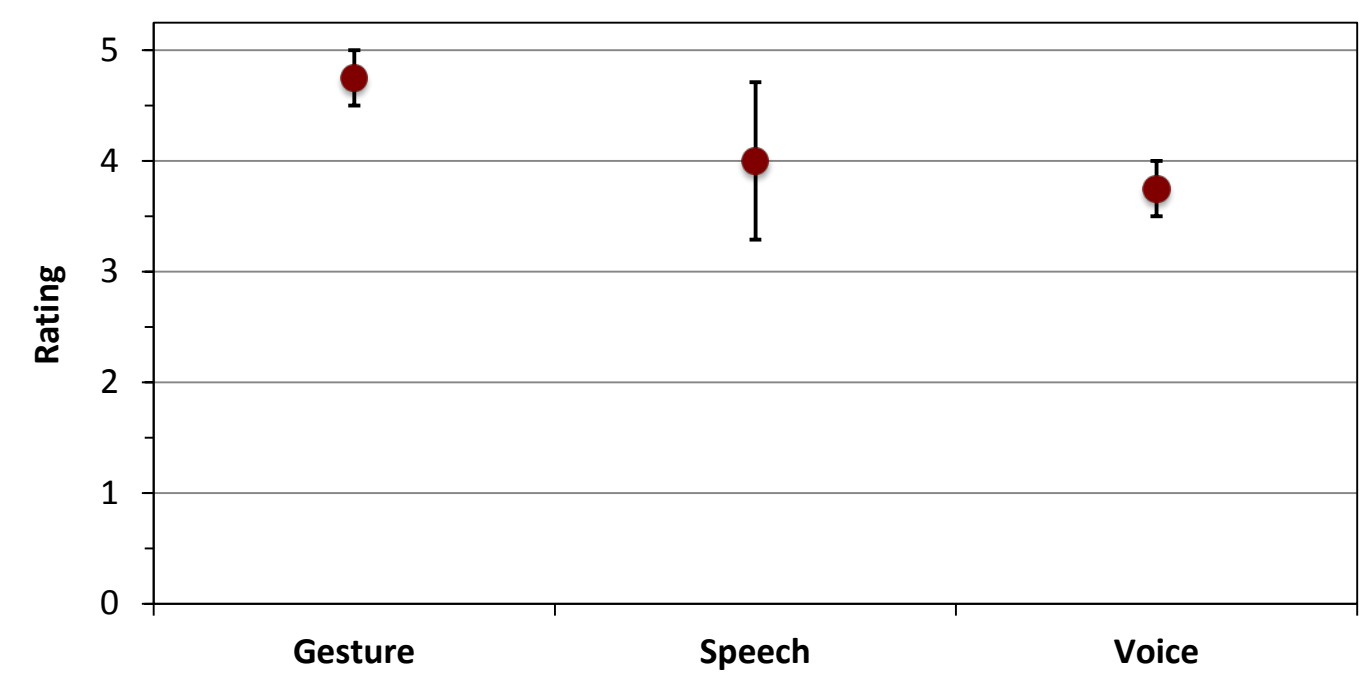
Routing



Gesture Input



Summarized results from gesture testing



User rating of NavPal outdoor app

MOTIVATION

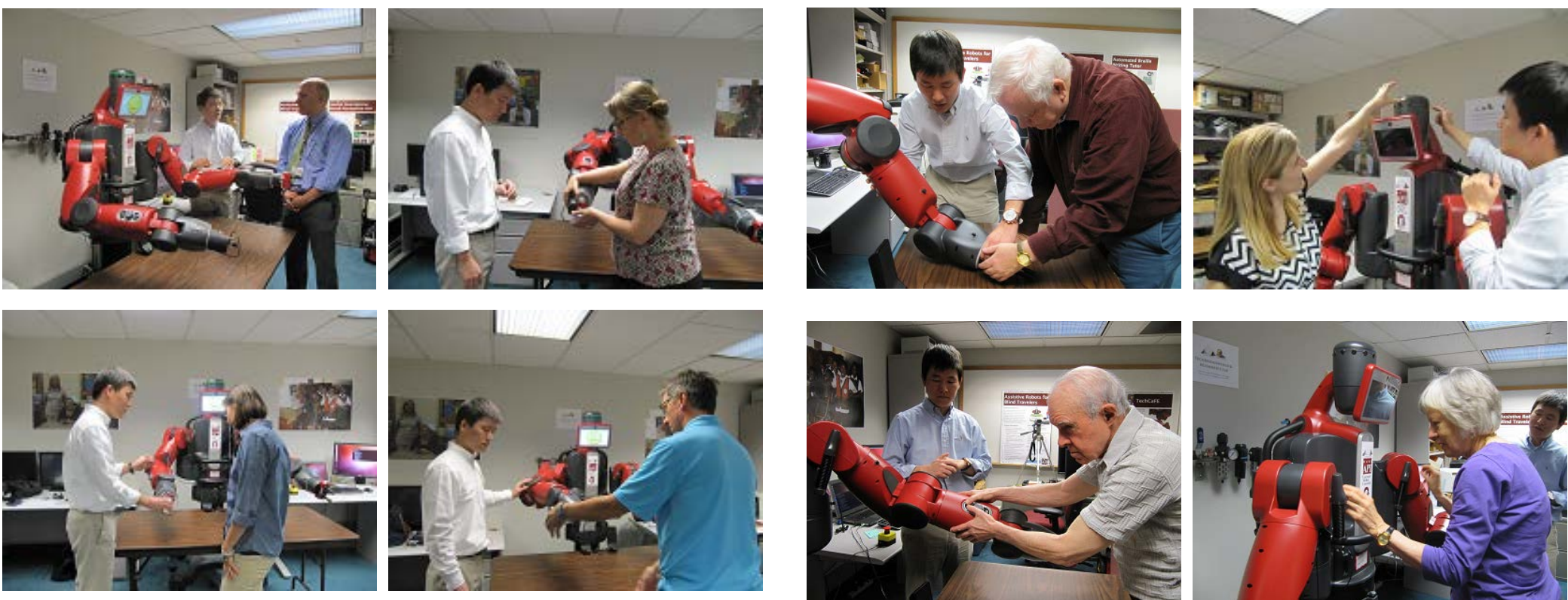
- 1+ billion people worldwide have some form of disability (WHO)
- Increasing due to rise in elderly population, and more war veterans and other trauma survivors
- Mobility tied strongly to employment, social inclusion, and personal independence



Strategies blind travelers utilize to navigate

INFORMATION EXCHANGE AND OBJECT MANIPULATION

- Provide travel related information, assist with locating objects such as a cell phone, help blind travelers sort unfamiliar documents, etc.
- Need Assessment: Sep – Oct. 2014
- Goal: Evaluate concepts and approaches for info desk robot
- Participants:
 - 6 sighted experts who work with blind community
 - 8 visually impaired
- Techniques: in-person interviews and online surveys



Interaction with sighted experts

Interaction with visually impaired experts

FINDINGS

- Identified high value robot task, functional constraints, and challenges specific to urban travel
- Robots viewed as useful/helpful for urban travel
- Accessible interfaces necessary to allow blind travelers to effectively communicate with all platforms

NEXT STEPS

- Continuously include visually impaired adults in our research to inform and evaluate progress
- Build and refine prototype technology solutions:
 - Mobile guide robot
 - Info desk robot (Baxter)
 - Smartphone indoor navigation app (NavPal)
- Use a combination of robots and smartphone carried by the blind travelers to achieve assistive urban and indoor mobility

COMMUNITY AND INDUSTRY PARTNERS



Western Pennsylvania
School For Blind Children
Fostering a Vision of Independence



Blind & Vision Rehabilitation
Services of Pittsburgh
Established 1919

