Introducing WayBot

A Wayfinding Assistant Robot for People with Visual Impairments

Katie Driggs-Campbell
Assistant Professor
Department of Electrical and Computer Engineering
University of Illinois at Urbana-Champaign

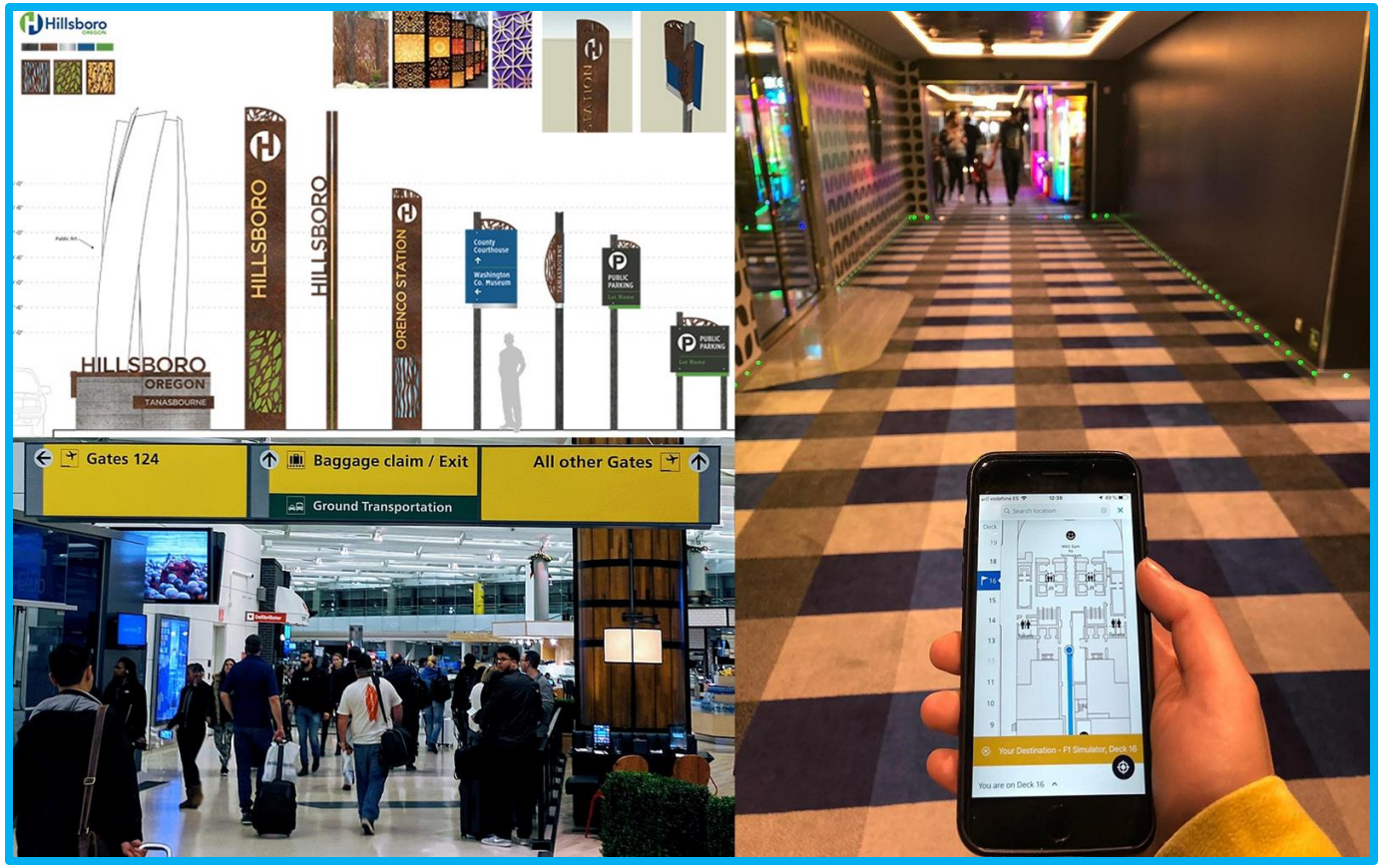
Presenting work in Collaboration with Wendy Rogers,
conducted by Megan Bayles, Aamir Hasan, and Shuijing Liu (and many, many others)

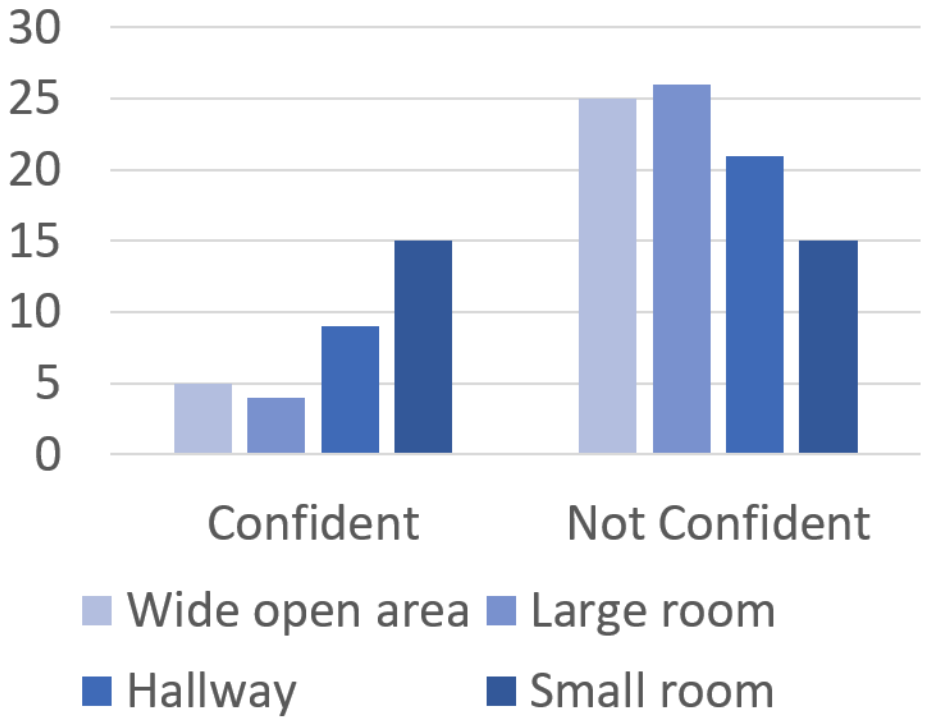
Rehabilitation Engineering Research Center on
Technologies to Support Aging among People with Long-Term Disabilities

TechSAge is funded by grant #90REGE0021 from the National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR), a Center in the Administration for Community Living (ACL), Department of Health and Human Services (DHHS).

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

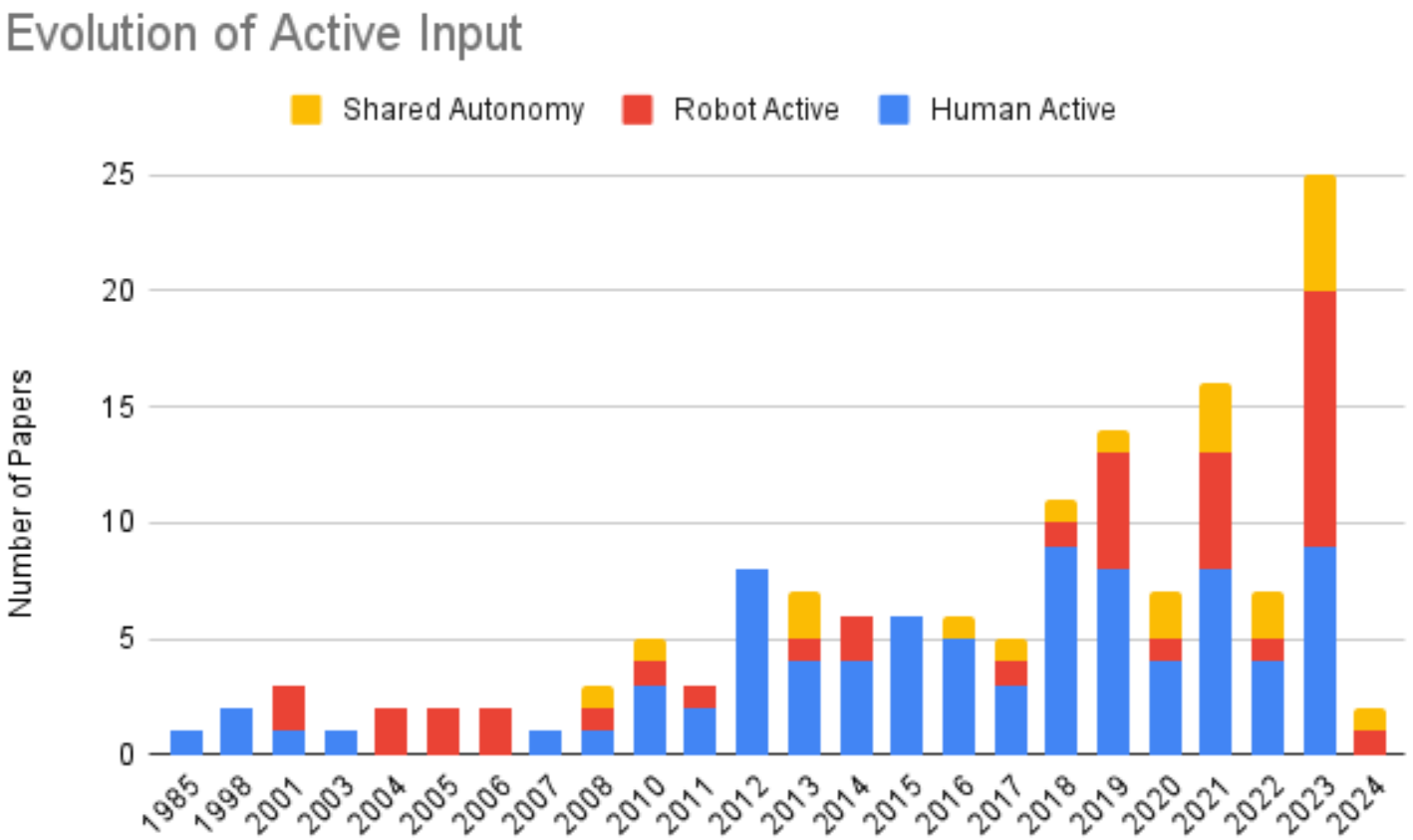
What is wayfinding?





W. Jeamwatthanachai, M. Wald, and G. Wills, “Indoor navigation by blind people: Behaviors and challenges in unfamiliar spaces and buildings,” British Journal of Visual Impairment, vol. 37, no. 2, pp. 140–153, 2019.

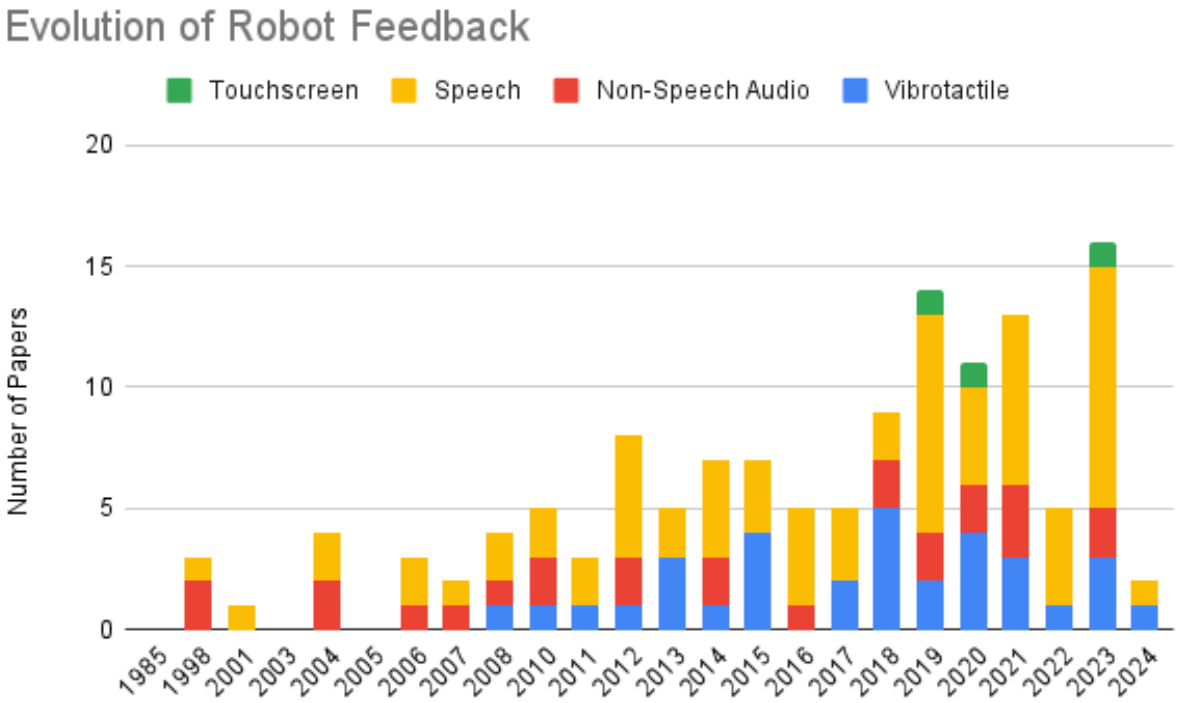
Technology Evolution for Wayfinding Support

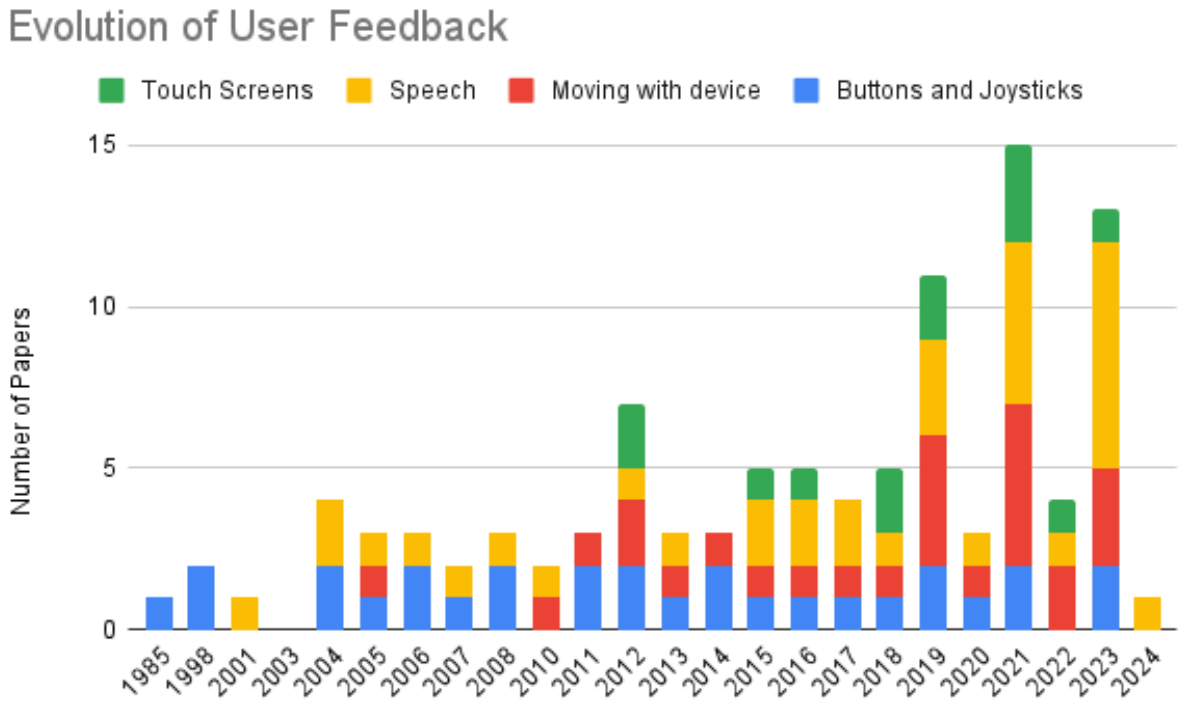


[Cabot, Guerreiro 2019]

Keep an eye out for our forthcoming survey paper:
Beyond Canes and Guide Dogs: The status of robot solutions to wayfinding navigating and orienting the visually impaired

Technology Evolution for Wayfinding Support





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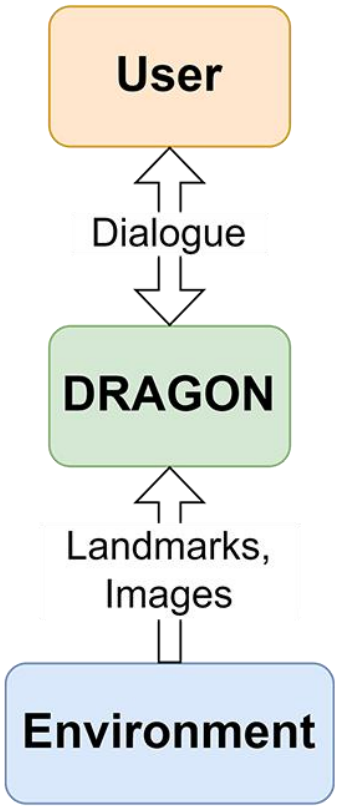
User Informed Design

- Conducted user needs assessment study to understanding tools and barriers for wayfinding in familiar, somewhat familiar, and unfamiliar environments
- **Familiar Environments:** little to no help is needed
- **Somewhat Familiar Environments:** Typically, assistance is needed as a *mental map* is built
- **Unfamiliar Environments:** Generally, a guide is needed, especially in less structured settings
- Gained additional insights on sighted guide practices, design preferences, and perceptions on robot assistance

Bayles, et al. "An Interdisciplinary Approach: Potential for Robotic Support to Address Wayfinding Barriers Among Persons with Visual Impairments," HFES, 2023
Olatunji, et al. "Developing Wayfinding Robotic Support for Older Persons with Vision Impairments," Journal of Blind Innovation and Research, Under Review 2024.

Introducing WayBot



Liu, et al. “DRAGON: A dialogue-based robot for assistive navigation with visual language grounding.” RA-L, 2024.

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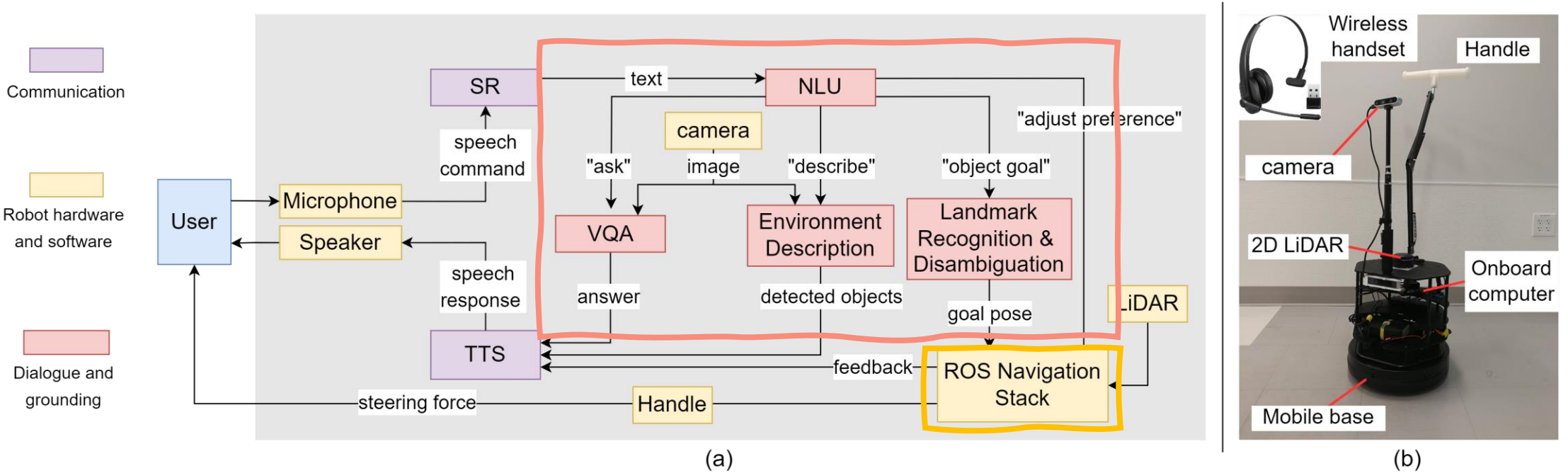

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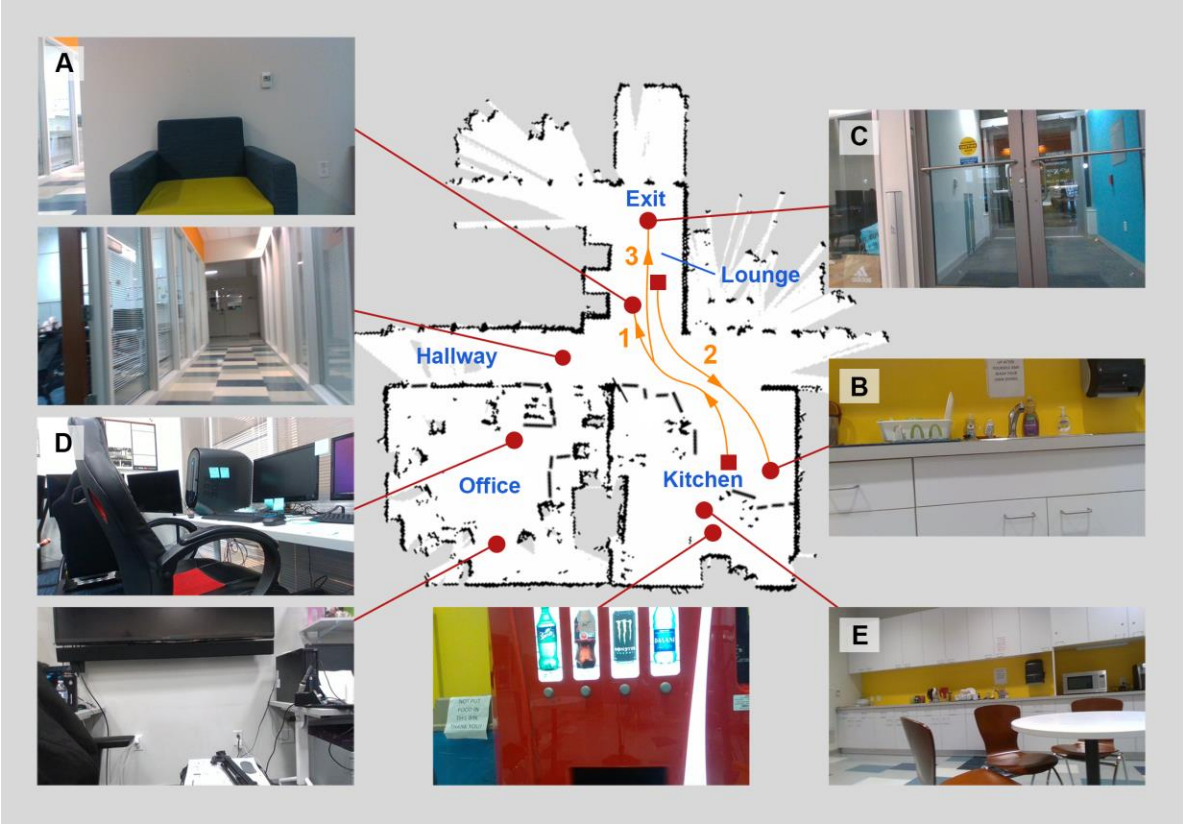
Interactive Communication with WayBot

- **Communication modules:** Speech-to-text and text-to-speech via a headset
- **Visual language grounding modules:**
  - **Landmark recognition:** modify CLIP (Radford et al. 2021) to match language commands to image goals on a map
  - **Environment description:** An object detector (Zhou et al. 2022)
  - **Visual question answering (VQA):** A finetuned VQA model (Kim et al. 2021)



Natural Language Understanding

Semantic goal recognition

Speed adjustment

Environment description

VQA

Liu, et al. “DRAGON: A dialogue-based robot for assistive navigation with visual language grounding.” RA-L, 2024.

DRAGON: A Dialogue-Based Robot for Assistive Navigation with Visual Language Grounding

Shuijing Liu, Aamir Hasan, Kaiwen Hong, Runxuan Wang,
Peixin Chang, Zachary Mizrachi, Justin Lin,
D. Livingston McPherson, Wendy A. Rogers, Katherine Driggs-Campbell

University of Illinois Urbana-Champaign

* This video contains sound

Thank you!

Katie Driggs-Campbell

krdc@Illinois.edu

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EXTRA SLIDES

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hello robot


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