Introducing WayBot
A Wayfinding Assistant Robot for People with Visual Impairments

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

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

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What is wayfinding?

Technology Evolution for Wayfinding Support

Evolution of Active Input

![Chart showing the evolution of active input from 1985 to 2024 with categories: Shared Autonomy, Robot Active, Human Active.]

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 [Cabot, Guerreiro 2019]
Technology Evolution for Wayfinding Support

Evolution of Robot Feedback

Evolution of User Feedback

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
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


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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

H: Hello, robot.
R: Hey! What can I do for you?
H: Can you take me to the door?
R: Do you wish to go to a door?
H: Yes.
R: Sure, taking you to the door.

H: Go slower.
R: Sure, decrease my speed from now.

H: What is around me?
R: One poster, one laptop computer, and one person.

H: Is it dark outside?
R: No.
H: Is there anyone at the door?
R: Yes.
H: What is next to the door?
R: Woman.

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

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* This video contains sound
Thank you!

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EXTRA SLIDES