Bus Stop Beacons: Transit Wayfinding for People with Visual Impairments

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Background and Purpose

- Navigating the fixed-route transit system is difficult for riders with visual impairments.
- Difficulty of using fixed-route creates need to use demand-response.
- Creating an easier fixed-route experience = more use fixed-route transit?
- First step is to improve wayfinding during the transit trip (finding the bus stop).

Wayfinding Technology: GPS

- Allows people with visual impairments to use their smartphones for navigation.
- Many apps already exist to assist people who are blind with navigation.
- Reliability varies and not precise enough to guide riders to the bus boarding area.
- Relies on accuracy of geo-coding and basemap.
- Cannot help someone find elevators, escalators.

80% of people who are blind use a mobile device.

Image credits: *satellite*: Created by Roberto Colombo from Noun Project | *smart phone with location marker*: Created by Symbolon from Noun Project

Wayfinding Technology: Bluetooth Beacon

- Small devices that transmit data using Bluetooth.
- Can be installed virtually anywhere.
- Some are ruggedized for outdoor use.
- Bluetooth signal can transmit information (like a unique code or website address).
- Can be detected up to 200 feet away.

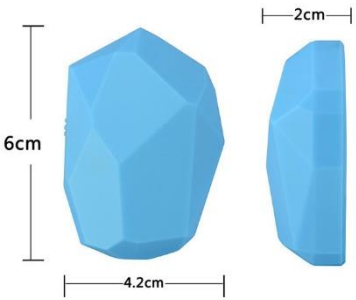
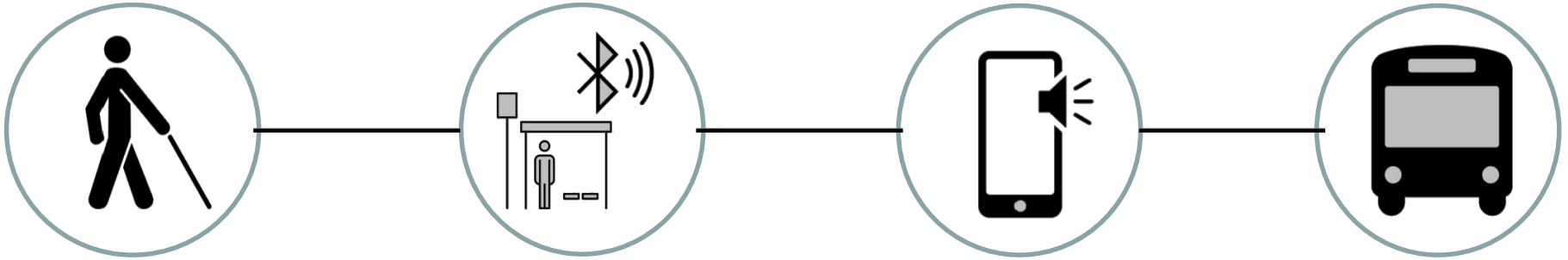


Image credits: *Bluetooth beacon*: Image from https://www.alibaba.com/product-detail/16-bluetooth-beacon-temperature-sensor-low_60300050097.html | *Bluetooth signal*: no credit needed | *smart phone with Bluetooth symbol*: Created by Symbolon from Noun Project.

Proof-of-Concept

- Test the use of Bluetooth low energy (BLE) beacons to transmit bus stop information (location, routes, next bus arrivals, etc.) to the smart phones of riders with visual impairments.
- In this proof of concept, riders with visual impairments tested whether the technology worked within METRO's local service.

How Bus Stop Beacons Work



A rider with a visual impairment (or any rider) gets within range of a transit stop.

The stop has a Bluetooth beacon installed that is constantly emitting a signal unique to that stop.

The rider's smart phone uses METRO's app to detect the Bluetooth beacon and present stop specific info using the phone's accessibility features.

The rider gets on-board when the transit vehicle arrives.

Project Methodology

Mobile Application

- Create mobile application using existing data sets and feeds.

Install Beacons

- Develop transit itinerary for focus groups.
- Install beacons on select bus stops.

Focus Groups

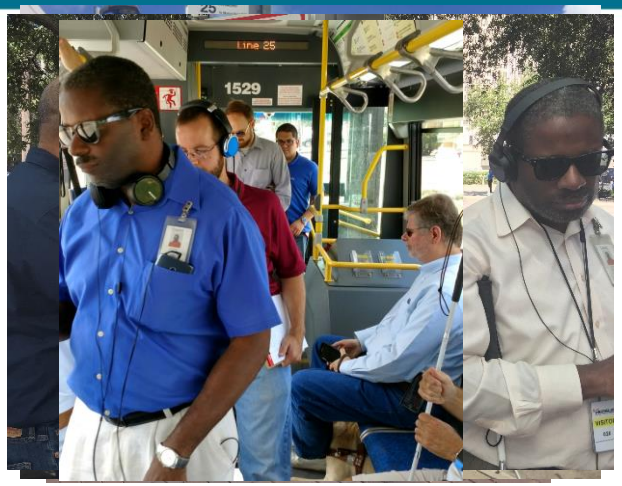
- Recruit people with visual impairments to test the app.

Two On-Site Testing Sessions

- Focus groups test the app in two separate sessions.
- Collect data and feedback from both focus groups.

Install Beacons

Two On-Site Testing Sessions



Session Introduction

- Introduction to study purpose and staff.
- Complete Historical Questionnaire.

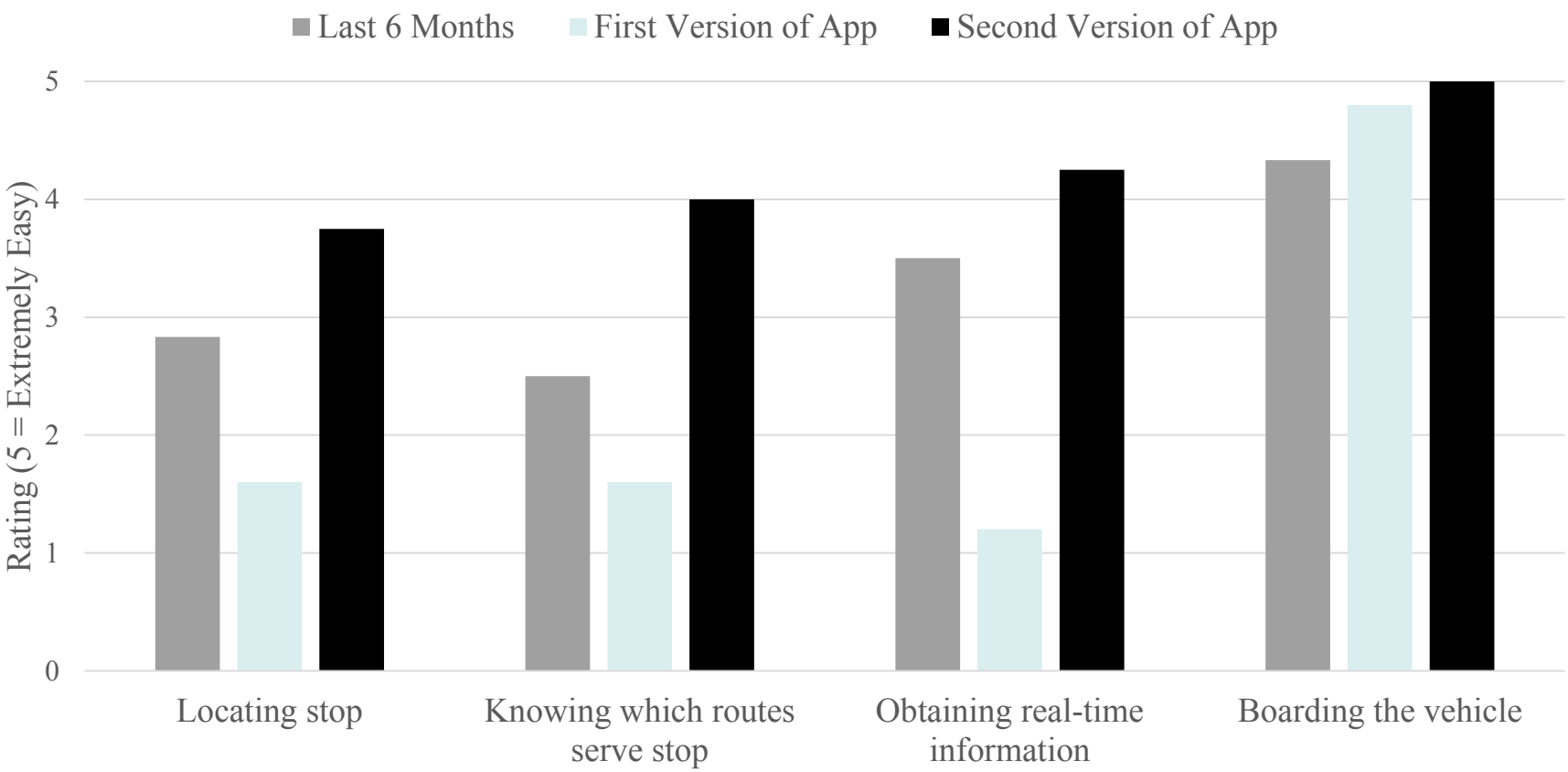
Ride Transit and Test App

- Participants rode transit using the app for navigation and real-time information.

Return to METRO and Debrief

- Complete App Assessment.
- Discuss strengths & needed improvements.

Questionnaire Results: Ease of Transit Trip Tasks



Questionnaire Results: App Usage

Would you use this app if all METRO bus stops were equipped with beacons?

- 100% were likely or very likely to use the app.

Would you recommend this app to other people with visual disabilities who want to use fixed-route transit?

- 100% were likely or very likely to recommend the app to others.

If all bus stops and rail stations were equipped with beacons and you had the app, how do you think your use of transit would change:

- At least half of the participants predicted their use of fixed-route transit would increase.
- Between 25% and 30% predicted their use of Demand-Response would decrease.

Image credit: thumbs up: Created by Chameleon Design from Noun Project

Lessons Learned

- Additional precision and guidance may be needed for adequate navigation (especially in transit centers).
- Multiple location sources (e.g., Bluetooth + GPS) may work better than a single source alone.
- Sound (i.e., a screen reader) cannot be the only way riders receive information from the app. Noisy environments make listening for spoken guidance difficult.
  - Simple sounds (e.g., bells or chimes) can be used for certain notifications.
  - Vibrations can be used to provide navigation cues and notifications.