Reimagining the Design of Accessible Indoor Navigation Technologies

A UX STUDY WITH PEOPLE WITH VISUAL IMPAIRMENTS IN INDIA

Google

Motivation

Several indoor nav competitors but none widely adopted

- share common goals like independence, safety & end-to-end navigation
- take a top-down approach to design

Imports from western markets

- ignores local practices of people in emerging markets like India
- goals of people likely different

Objective

- Outline product strategy & vision for an AI based accessible technology that assists people with visual impairments in India with indoor navigation

Team composition

- Worked with a team of highly technical AI experts for 3 months
- Team had not worked with a UX researcher previously
- Team had a technology-first approach to design
  - *State of research*: Robot with navigational capabilities i.e., inbuilt turn by turn directional & obstacle avoidance mechanisms
  - *Goal*: Transfer navigational capabilities to people with visual impairments via app

Project Role

Managed project

- established project timeline
- ramped up on Google processes
- negotiated with vendors & halved costs with them

Led user-research

- created research plan
- led data collection & analysis
- advocated for user-centered principles & methods

Research Questions

- How do people with visual impairments in India navigate indoor environments?
  - What are their day-to-day strategies & interactions when they navigate indoor environments?
- What are key design considerations for AI-based accessible technologies to support these strategies & interactions?

Sampling & Participant Demographics

- Purposive sampling

- People with visual impairments
  - 6 men & 5 women between 21 & 55 years old
  - low to middle-class socio-economic status

- Companions
  - 2 men & 3 women between 31 & 60 years old
  - close family members of people with visual impairments

Method Considerations

- Work within budget & 1 month data collection timeline
- Support remote data collection
- Yield evidence for UX advocacy
- Include multiple data sources
  - Can interrogate & validate each other
  - Lend more strength to claims

Methods Overview

Primary: Semi-structured interviews

to understand indoor navigation strategies

with 11 people with visual impairments + 5 companions

Secondary: Video-diary study

to capture tacit micro-interactions

with subset of 5 people with visual impairments from interviews

Interviews

Included situational & scenario-based questions

- lasted 60-80 minutes long

Worked with moderator & translator to conduct interviews

- conducted working sessions to establish study purpose & describe protocol
- established messaging channel for during-interview follow up questions

Generated verbatim transcripts for analysis

Video-diary Study

Received video clips of people navigating indoor spaces

- 1 week duration
- received 22 video clips (average duration ~1 min 32 seconds)

Worked with buddy to record videos

- recruited through participant
- preferred over phone lanyard & go-pro camera options
- served as safety net & ensured people could focus on navigating

Produced detailed field notes for analysis

Data Analysis

Data triangulation

- used affinity mapping to analyze data in parallel with collection
- generated codes & themes
- used constant comparison to interrogate & triangulate data

De-briefs after triangulation

- probed about interactions in videos
- resolved any contradictions

Cross-functional Collaboration

Continuous & longitudinal involvement of stakeholders

- provided feedback on research materials
- invited to interviews to observe & ask questions
- de-briefed interviews & videos to brainstorm ideas
- discussed intermittent findings during weekly share-outs

User Snapshot

Samantha

- *Age*: 44 years old
- *Location*: Mumbai, India
- *O&M trained*: Yes
- *White cane use*: To get sensory cues
- *Views on navigation*: ”Complicated and cognitively demanding”

Strategic Design Principles

- Embodiment
- Collaborative
- Learning

Embodiment

- Navigation is a complex embodied process that involves triangulation of sensory cues
- Navigation skills are tacit & hard to articulate
- Design principle of embodiment: Include people with visual impairments as critical stakeholders in project

Collaborative

- People always navigate with companions
- Companions address goals of independence and safety
- Design principle of collaboration: Extend unit of design to include person with visual impairment & companion

Learning

- Indoor navigation entails awareness building & skill acquisition
  - people learn to navigate by developing awareness of environment attributes & objects
- Design principle of learning: Reimagine navigation as a learning exercise & use technology to support learning

"Caretaker told me trunk (outside office) is hanging out so be careful. I was told that there is a kitchen here, there is a desk here, the bathroom here. The founder of the company he helped me understand all of this. Two–three times this happened then it became familiar."

Impact

- Project strategy: Advocacy, collaborations & insights resulted in job requisition for person with visual impairment on project
- Project vision: Allocated budget to work with UX to understand collaboration & learning scenarios in-depth

"We have been looking at indoor navigation as the problem of navigating a robot, which we can't really do" – Lead engineer on project

"It is clear that we have to move ahead keeping help in mind" – Project Manager

Key Takeaways

Indoor navigation involved key interactions & strategies

- requires the triangulation of sensory cues
- entails working with others
- necessitates building awareness & acquire navigation skills

Strategic design recommendations

- *Embodiment*: include people with visual impairments as key stakeholders
- *Collaborative*: extend unit of technology design to include people with visual impairments & companions
- *Learning*: reimagine navigation as a learning exercise & support learning