NavMe: Challenges of Crowdsourcing Indoor Context

Lahlou, A.

A system for Indoor Navigation

What is NavMe?

- A project

- A framework

How can a person with VBI navigate indoors

The Big Problems

Take a survey of the problem from different point of views:

- User
- Engineer
- Ad-hoc crowd
- Stakeholder

User Requirements

- Must not depend on visual ability
- Cannot interfere with other senses
- Inconspicuous, non-stigmatizing

- Helps with mental maps

Engineer

- How to scale
- Keep costs low
- Validating crowdsourced data
- Fix data decay

Ad-hoc Crowds

- Clear directions
- Low cognitive load
- Self-correcting
- Rewards

Problem Overview

- Hands-free, inconspicuous, safe user directives – using smart watches in addition to smartphones to deliver on the wrist directives. Compared to other approaches such as haptic cane handles.
- Guaranteeing crowdsourced data quality at collection time – real time, local methods that involve machine and human computation.
- Find-Fix-Verify redesigned for NavMe – while not immediately transferrable, using users as an ad-hoc crowd to improve data corpus.
- Machine-based approaches for data verification and correction for building information
- Machine-based approaches for detecting data decay for building information
- NavMe as a training tool for developing mental maps

TL;DR - Lots of problems

TL;DR - Lots of problems

Time to get creative

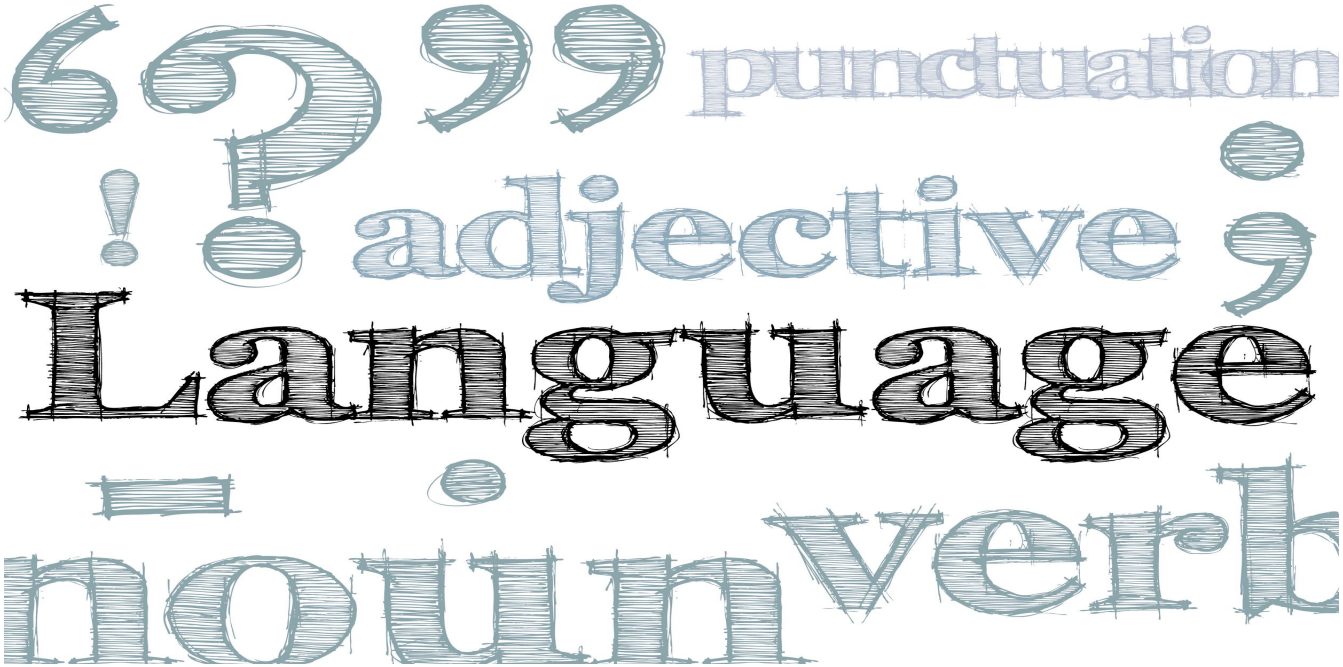
TL;DR - Lots of problems

Time to get creative

and break it down

Marking up a building

Make a “language” for describing buildings



Benefits

- Great precision, accuracy
- Restricts data decay

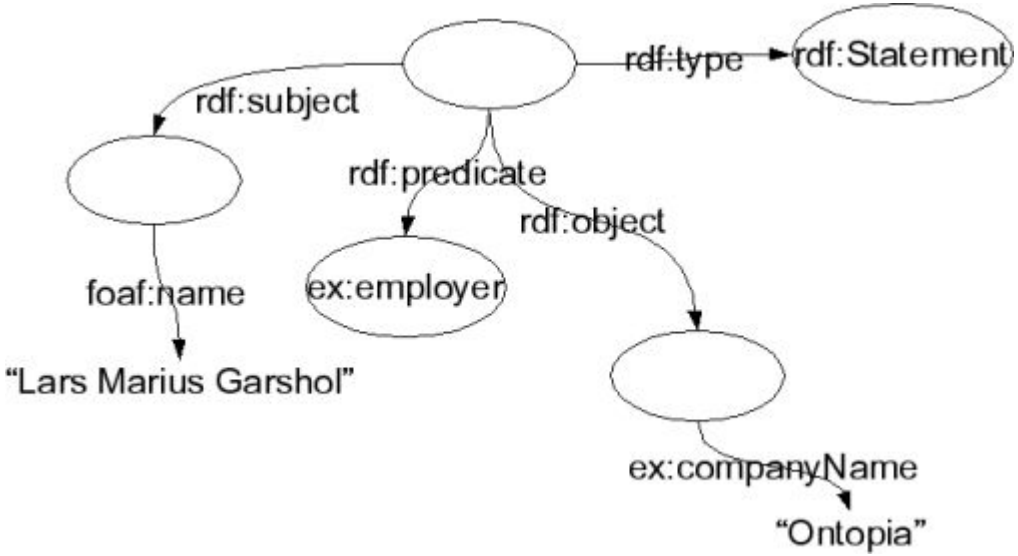
- Most importantly, enables knowledge driven expert system

First Step - Formalizing Declarative Facts

- Adhere to OpenCyc/RDF standards

Obstacles, scenarios, time to live,

constraints, probabilities



"Stairs must include elevation change....doors must be solid"

First Step - Formalizing Axioms

- The least properties that we must assume so that we can reason with our facts

Distances can be added, paths are composable, reversing path reverses partial equivalence trait

First - Formalizing an Interpretation

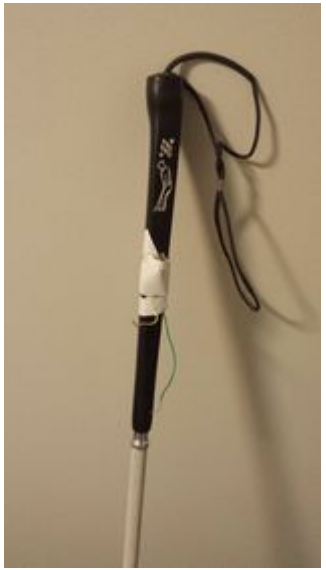
Goals of interpretation:

- Verifies new data
- Gives feedback to user
- Prompts user to collect more information
- Handles data decay

Using smart devices

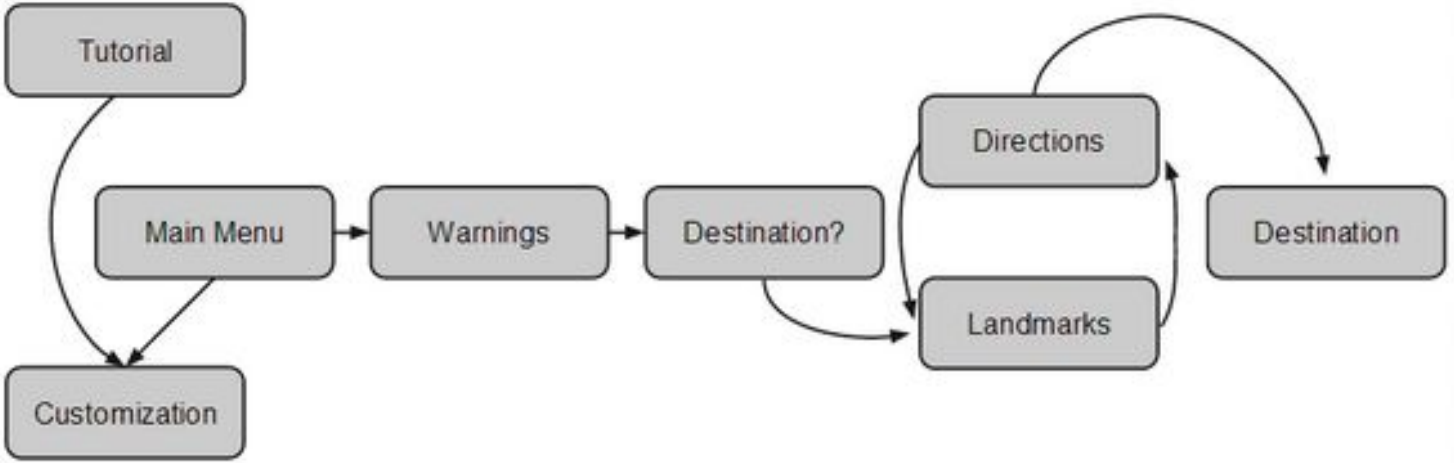
- Deliver inconspicuous, safe directives while even being stylish.

- Enable on the fly input with low cognitive load. Tacit improvement over time



Form factor

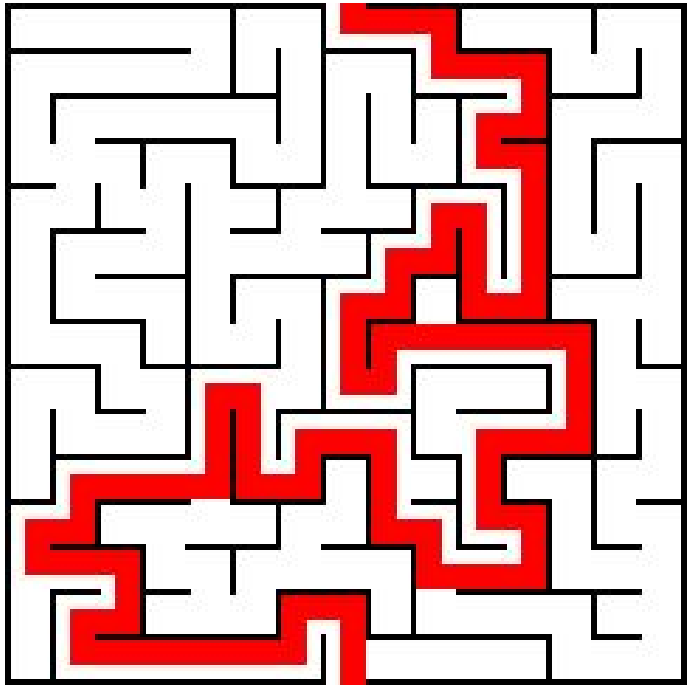
Usage Story


Tutorial
Main Menu
Warnings
Destination?
Directions
Landmarks
Destination
Customization

Machine-Based Strategies

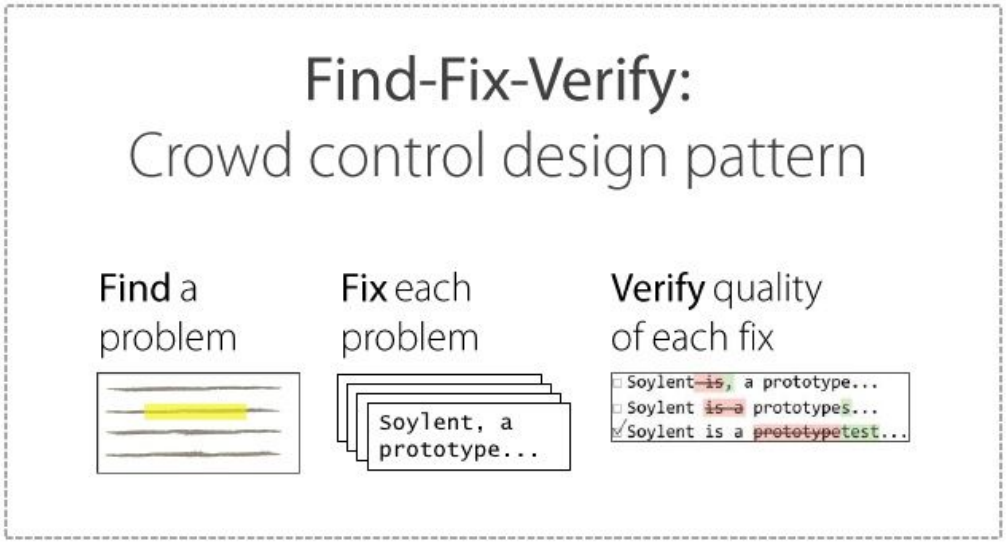
- Collecting paths
- Leveraging the ad-hoc crowd
- Leveraging the first time user

Collecting Paths



Leveraging Ad-hoc Crowd

- Social Rewards by ranks, similar to Stack Overflow (explorer, commando, etc.)
- Find-Fix-Verify, breaking up problem into smaller parts



Leveraging the first time

- No competing mental map
- Can make assumptions about their usage of NavMe

The most raw, the most honest data is from them. So it should be weighted more.

Thank you

Acknowledgements

- The Friedman Place
- Segal Design Institute
- The Norman Fund Foundation
- Mellon Mayes Undergraduate Fellowship