# NavPal Outdoor App

## *Android outdoor navigation application for blind travelers*

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## Introduction and Motivation

- More than 10 million people are blind or visually impaired in the US
- Limited tools for navigation
- Limited information about the environment
- Limited modalities for indepth safe travel
- Limited accessibility

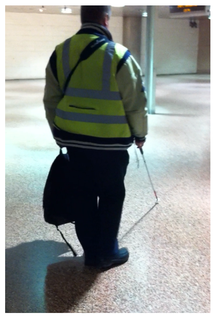


**Fig 1.** Strategies blind travelers utilize to navigate

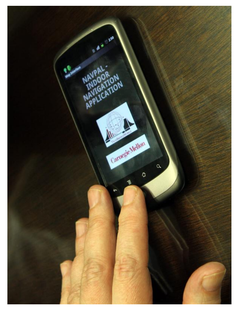


**Fig 2.** NavPal indoor interface

## Objectives

- Develop **main architecture** of the NavPal outdoor application: localizer, route planner and path extractor
- Make interface **highly accessible** for blind users
- Develop an interface for **trusted user contribution** to app
- **Breadcrumb approach** for users to customize their route information.
- Make the app's interaction user **customizable**

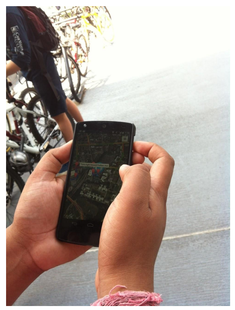
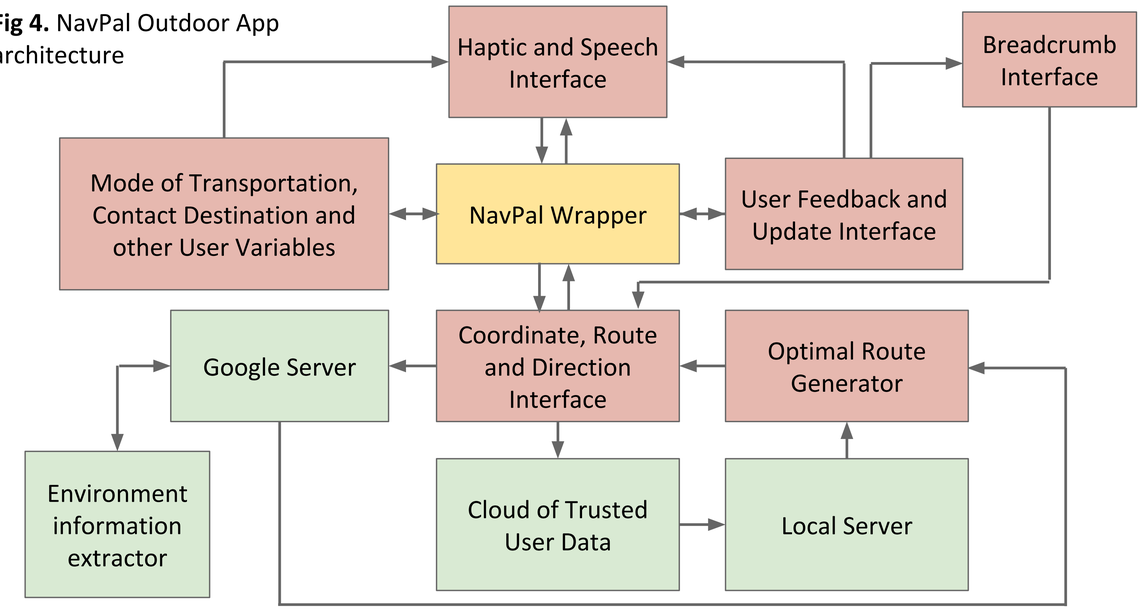


**Fig 3.** NavPal Outdoor Interface

## System Design and Overview

**Fig 4.** NavPal Outdoor App architecture



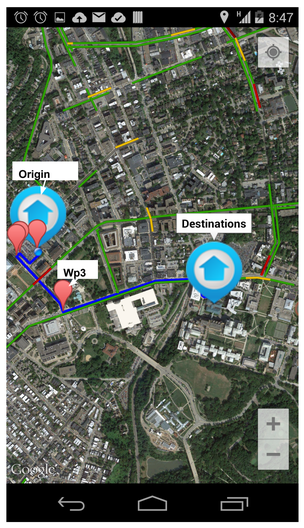




**Fig 5.** Route Planning

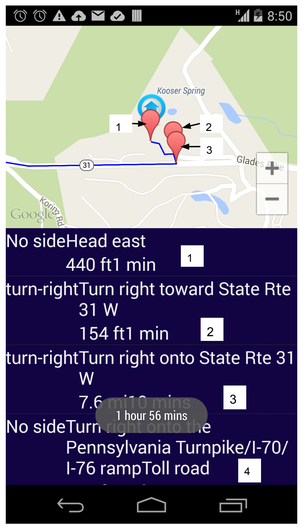



**Fig 6.** Direction and Coordinate extraction

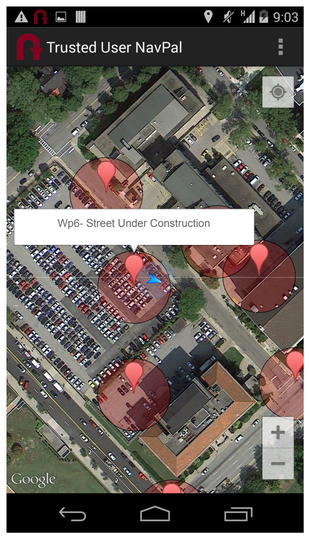
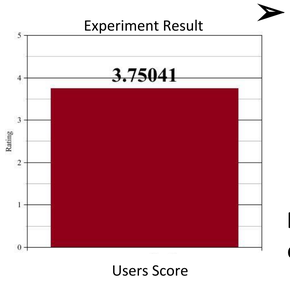



**Fig 7.** Interface for trusted user data contribution

## Initial User Testing

- **Aim**: To study app's accessibility level
- **Participants**: 4 Blind and visually impaired
- **Experiment**: The users were given a demo for learning and later were asked to use the app. Each area was rated based on some predefined command flow.




- **Test Areas:**
  *Accessible Gestures
  *Speech Recognition
  *Text to speech interaction

**Fig 8.** Users score from the experiment result

- Feedback from participants
  - *"would like variable **verbosity**."*
  - *"would like **traffic and Crossing** Information."*
  - *"liked **breadcrumb** waypoints approach."*
  - *"**highly recommend** the application."*

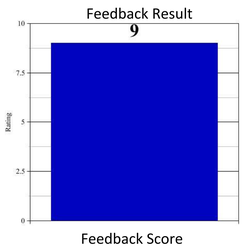



**Fig 9.** Feedback score from users on app's overall performance

## Conclusion

- Navpal outdoor app's basic architecture was developed and tested with blind users. The apps performance with respect to the initial user testing, showed that the app was highly accessible and easy to use.

## References

- Hend Gedawy, "Designing interface for indoor navigation system for visually Impaired", M.S Thesis, Dept. CS CMU, PA, 2011.
- Kannan, Balajee, et al. "Localization, Route Planning, and Smartphone Interface for Indoor Navigation", *Cooperative Robots and Sensor Networks*. Springer Berlin Heidelberg, Volume 507, pp 39-59, 2014.

## Acknowledgements

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## Future Work

- Some of the future work for NavPal outdoor app, is to remove the dependence on the google servers, and to make custom routes based on users preference.
- Other works include user testing on app's navigation performance and interface like breadcrumb approach