People Helping Computers Helping People: Navigation For People With Mobility Problems By Sharing Accessibility Annotations

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Mobile Applications Group - MAG

We are a group of 6-8 researchers at Østfold University College working on different aspects of mobile and social applications. Some of our research interests are:

- Creative use of mobile technology.
- Location based services.
- Users and technology.
- User generated content.
- Open source, formats and data.
- Security and reliability.

Our involvement with accessibility mapping

We got involved in an accessibility project involving several actors, including the municipality of Oslo, The Norwegian Association of Disabled, Norkart and others. We

- developed a mobile client for viewing accessibility information.
- added opportunity for annotating obstacles with pictures and text.
- evolved the idea into route planning based on user feedback.
- undertook interviews, assessing motivation for contribution, trust issues etc.

The resource challenge

From our involvement with the accessibility project, and from experience with standardization of geodata, we knew the process of gathering accessibility information

- required detailed surveying.
- relied on objective measurements.
- involved complex forms and schemas.
- was labor intensive.
- depended on skilled volunteers.

Inspiration

The OurWay idea is inspired by the increasingly widespread participation of end users and user generated content, such as in

- the Open Source movement.
- wiki's - for example Wikipedia.
- social navigation in general.
- recommender systems in particular.
- crowdsourcing initiatives such as OpenStreetMap.

The OurWay idea

We wanted to investigate the viability of a system where accessibility information was collected by end users, through their use of the system.

- Let the users annotate accessibility of their surroundings.
- Leave room for subjective opinions and diverse user groups.
- Low threshold for contribution - low granularity of feedback (good, uncomfortable, inaccessible).
- Instant sharing of annotations with other users.

A conceptual demo

TODO: [Insert “animation(s)” here]

The first OurWay prototype

The first prototype was developed as part of a master project in our group, by Håkon Holmstedt. It consisted of:

- A mobile phone with GPS.
- A route planning server.
- A mobile, map based application for requesting and viewing routes, as well as provide feedback.
- Geographic network covering the city of Halden.
- A desktop application facilitating follow-up lab experiments.

First experiment - baby strollers

To start evaluating the concept, we conducted an outdoors experiment with the researchers as system users.

- Proof of concept evaluation.
- Used baby strollers to impose physical restrictions.
- Testing route convergence rate and distance penalty factor.

Baby strollers - findings

Through the outdoors experiment we made some promising observations.

- The annotation process converged surprisingly fast.
- Three levels of user feedback worked well, although “good” was almost never used.
- We identified suitable weights for the three different annotations.
- Satisfactory routes were typically only 5 to 15 percent longer than the shortest path.

The second OurWay prototype

We decided to take the concept indoors, to be able to do a more controlled study of the OurWay users. We rewrote the OurWay server and client for this.

- A mobile phone.
- Manual positioning.
- A route planning server.
- A geographical network covering the five floors of our campus building.
- Predefined navigational tasks.
- A map-based client for requesting, viewing and annotating routes.

Second experiment - indoors wheelchair navigation

Our second experiment aimed at better understanding how the users annotate and why.

- Focus on users and annotation behavior.
- Users in wheelchairs
- A set of predefined navigational tasks.
- Observations and interviews.

Indoors navigation - findings

Some of the lessons learned from the indoors experiment were:

- Users mostly annotated only for their own benefit.
- The only predictable annotations were inaccessible obstacles.
- The concept still provides benefit for subsequent users, as a by-product.
- The convergence rate is very good, as was expected.

Current usage: Route finding

The usage of OurWay has so far been the end user's quest for a manageable route from A to B.

- User requests a route from A to B ...
- and follows along the route.
- If an obstacle is encountered, the user annotates the route segment, and requests a new route from the current position, if required.
- The annotation is immediately available for subsequent route planning.
- This use requires a partially prepared network, unless one is prepared to "pioneer" an area.

Proposed usage: Surveying

We propose that the OurWay concept can be used in an organized, campaign like setting:

- Coordinated users with a common goal.
- Common guidelines for annotation.
- The group can cover an area or building in a short amount of time.
- Multiple user groups can be represented in the effort.

Proposed usage: Accessibility verification

Further, we propose OurWay as a tool for verifying and/or documenting the accessibility of an area.

- Data can be either historical, from a campaign or both.
- Annotations can be exported and presented in various ways.
- This documentation can be presented for building owners, policy makers, regulators etc.

The role of openness

Openness is inherent in most of our group's work, and as such there are several aspects of openness which are valuable to the OurWay concept.

- Open geodata provides a low-cost, freely available and tailorable data source for the route planner.
- Open source tools and frameworks is used in all aspects of the system.
- Open, user generated content in the form of annotations is what makes the system adaptable.

OpenStreetMap

OpenStreetMap provides infrastructure, data and tools that we use in the OurWay project.

- A wiki map of the world
- Started in 2004 by Steve Coast.
- Has thousands of contributors world wide.
- User generated, caters for all kinds of users and uses.
- The actual geodata is available under a CC licence.

Challenges and future work

Although our results so far are encouraging, there are several issues that needs more work before the concept is ready for real-life use.

- A larger scale experiment, outdoors, over time
- Dealing with temporary obstacles
- Handling disagreeing annotations.
- Properly handle diverse user groups.
- Interaction and usability issues.
- Security and reliability issues, including trust management.

In summary . . .

- OurWay is a concept which allows end users to annotate their environment with regards to accessibility.
- We have promising results so far with regards to convergence rate and feasibility of the concept.
- We have described one type of use, and proposed two complementing usages.
- We have identified a number of themes for future research.

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