Problem: Lack of images

Advantages of image-based approaches to pedestrian navigation systems have been demonstrated in several studies. One serious problem therein is the creation of images covering sufficiently wide area which probably will not be solved in the near future.

Approach: User-generated Content

Encouraging users to create image content for such systems is a possible solution to the lack of image databases. There are efforts to open up the content map-based systems rely upon (e.g. OpenStreetMap). However, to our knowledge, the only existing product that supports users in creating content for image-based navigation is the application BreadCrumbs. We know of no scientific investigations of user-created content for image-based navigation.

Mobile Route Authoring

For an authoring system, users should be able to:

• Take photographs
• Annotate navigation information

We developed 3 different user interfaces for annotating photos on the go:

1. Separate annotation (alongside text and iconic direction instructions)
2. Perspective annotation (simplified Augmented Reality, sAR)
3. Freehand annotation (drawing in the manner of a simple paint application)

For the first two annotation interfaces we had to restrict the set of instructions the author could annotate to a degree that users were able to handle but which would still let them express themselves.

As we are not aware of any standards we determined common functionality for the other variants by conducting a small-scale exploratory study using the freehand variant before the other two were fully implemented.

Evaluation

The goal was comparing the authoring UIs regarding usability:

• Field setting
• Route about 750 m length including various situations
• 3 groups of 5 participants (overall comparable age and experience)

The participants were asked to create complete route instructions by taking photographs and annotating them such that a user unknown to the area and route could find their way from start to end by incrementally navigating from waypoint to waypoint.

Annotation mean times

Participants using the freehand interface were significantly faster than those using the fixed layout or perspective interface.

Average corrections

The average corrections made by users of the perspective annotation were significantly higher than the corrections made by users in other groups.

Conclusion: Time and precision aren’t always the determining factors

The times of completion and correction rates clearly show that the freehand annotation is superior. However, qualitative insights gained in observation and interviews imply that participants put a high importance on the visual clarity and perfection of their annotations. Further they seemed to favour annotations in perspective despite a more complex editing process. The results favour a visual integration of image and instructions and freehand editing over constrained editing.

Currently we are evaluating the visualisations produced by the three interfaces from a viewer perspective in order to fully assess the trade-off between ease of use for route authors and route followers in image-based pedestrian navigation.

Examples of images created due the evaluation

• With the perspective annotation users created the most complex annotations. This was not obvious, as it also allows creating single arrows with one tap of the screen.
• The perspective annotation invited users to fine-tune the route depictions, creating visually pleasing annotations.
• Observation and feedback garnered in interviews validated that users put much importance on the quality of their photographs and annotations.