

Development of a public gaze-controlled Campus Map

Geomatics Master – Interdisciplinary Project Fall 2017

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1 Introduction

The aim of this project was to develop an interactive digital campus map which can be controlled by the gaze of a user alone.

Until today visitors, students and staff of ETH Zurich have to collect their information about looking for points of interests from different sources such as paper maps, floor plans within the buildings and several different websites. To facilitate the search of the user, this information should be collected and displayed in the new campus map. Furthermore, gaze-based interaction represents a promising alternative to touch input, since with it the display size is not limited to an arm's length and it is natural and easy to use.

2 Concept

We developed an interactive web campus map with the concurrent effort of incorporating eye gaze as input modality into this specific human-computer interface.

Map functionality:

- Choose the identity of the user (employee, student, visitor).
 - Show frequent asked questions (FAQ) accordingly
- Select outdoor point of interests (POIs)
 - Show them on the map
 - Route to selected location on the map
- Indoor navigation
 - Show floorplans
 - Route to selected rooms

Design consideration

- GUI design supporting gaze input (large buttons, indication bar)
- ETH corporate design

3 Implementation

Eye tracking

- Use of Tobii TX300 eye tracker
- Gaze detection based on OnlineIDT algorithm. The algorithm is a modified implementation (online computation) of the I-DT algorithm based on the description included in Salvucci & Goldberg, (2000)

Data acquisition

- Data from OpenStreetMap (outdoor) and ETH Zurich (indoor)
- Transformation of DWG- to SHP-files for indoor data with FME
- Data publishing on Portal for ArcGIS

Routing

- Computation of indoor routing network with ArcGIS
- Routing service of Portal for ArcGIS

Campus map

- Web design with HTML, CSS and Bootstrap
- Web implementation with JavaScript, AngularJS and ArcGIS API

Software architecture



4 Results and discussion



Participant Interface Gaze Indication & Hovering

Fig. 1. User interaction with the gaze-controlled campus map (roll-out study).

We conducted a roll-out study during one week with 45 participants (ages from 21 to 78). During the study all participants were asked to answer a questionnaire which includes the 10 questions of the system usability scale (SUS) (Brooke, 1996).

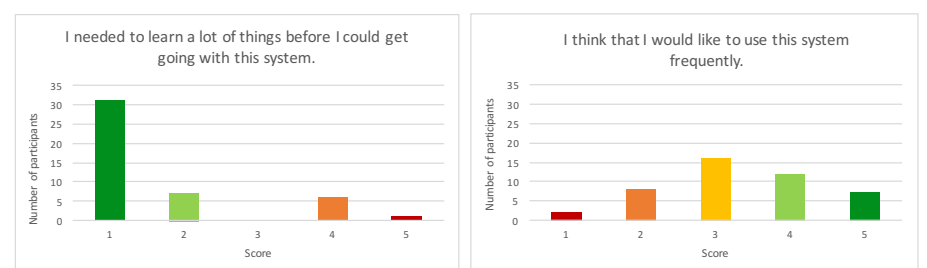


Fig. 2. Sustainable usability scale (1: strongly disagree, 2: strongly agree)

Feedback was generally positive. We scored 71.4 in the SUS, which is a satisfying result for a prototype, but also indicates the necessity for further improvements (mainly optimization of the calibration). We also noticed that young people had a better user experience than older people who found the system less intuitive to use.

5 Conclusion and future work

We succeeded on developing a working prototype. The study showed that it is a promising product but many improvements have to be done. The more experienced the user is with gaze based applications, the better the overall interaction is. In order to obtain a ready product, we propose the following works:

- Calibration optimization
- Adjust GUI more properly based on gaze input
- Optimization of the routing network
- Improve routing visualization
- Send search results to portable device or printer

6 References

Salvucci, D.D. and Goldberg, J.H., 2000, November. Identifying fixations and saccades in eye-tracking protocols. In *Proceedings of the 2000 symposium on Eye tracking research & applications* (pp. 71-78). ACM.

Brooke, J., 1996. SUS-A quick and dirty usability scale. *Usability evaluation in industry*, 189(194), pp.4-7.