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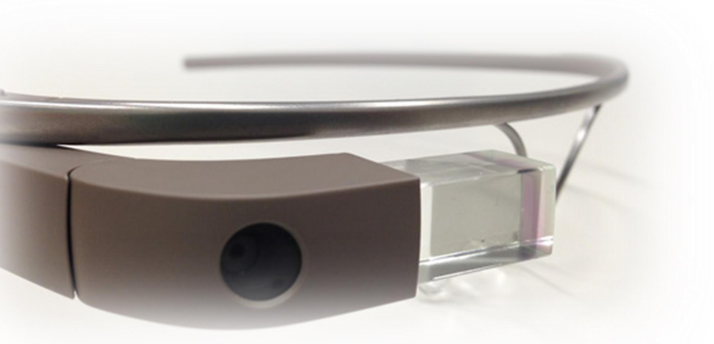

Interaction methods for Web Map Services on Google Glass

Author: Christian Peier
Advisors: Ioannis Giannopoulos, Dr. Peter Kiefer, David Rudi

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Supervisor: Prof. Dr. Martin Raubal

Introduction

Optical head-mounted displays (OHMD) are not yet wide spread but hold a great potential, also for example in relation to map navigation tasks. A frequently common use of such an OHMD might be map applications, where the user is interested in manually searching desired locations on the map or get navigation aids from the map application.

Known from common map applications, zooming and panning are two elementary interaction methods in map applications. For both interaction methods, the user needs an assigned input method of the device.

STATEMENT OF PROBLEM

Currently, there are no advanced map applications for OHMDs available.

Input methods for map interactions panning and zooming cannot be implemented the same way for OHMDs as for smartphones, tablets or desktop computers due to different user input methods and display sizes.

RESEARCH QUESTION

Which of the investigated input methods from the OHMD are the most effective and efficient and provide a richer user experience for map interactions?

OHMD

OHMDs, which belong to the group of wearable computers, have a small computer fixed on an eyeglass that allows information to be presented on a screen in the field of view independently of the head rotation. The hands are free to use for other things. The screen is semi-transparent and lets the user see her surroundings as well. Google Glass is probably the most popular example of such an OHMD.

M100 Smart Glasses, Glass Up, Recon Jet (from left to right)

Methods

As prerequisite for reaching the aim of the work, a standardized WMS client for Google Glass was developed.
In order to find the best input methods, a user study with 32 participants was conducted.

WMS CLIENT

The following functionalities were implemented in the WMS Client:

- Choose WMS URL
- Interpret getCapabilities-XML from server
- Display getMap-image from server
- Layer visibility settings
- User interaction for zooming and panning

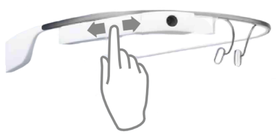
USER STUDY

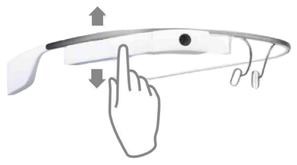
The study follows a within subject design. All participants solve all tasks with all corresponding configurations (input methods). In each task, the participants have to zoom or pan to several goal locations.

Task 1: ***Test four zoom input methods***

Head gesture recognition(1)

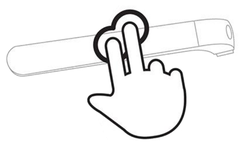
(2) Horizontal scrolling



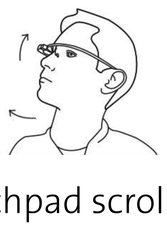


Vertical scrolling (3)

(4) Press and hold with two fingers for zoom in and with three fingers for zoom out

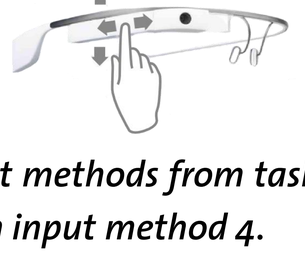


Task 2: ***Test two pan input methods***



Head gesture recognition (1)

(2) Touchpad scrolling



Task 3: ***Test both pan input methods from task 2 in combination with zoom input method 4.***

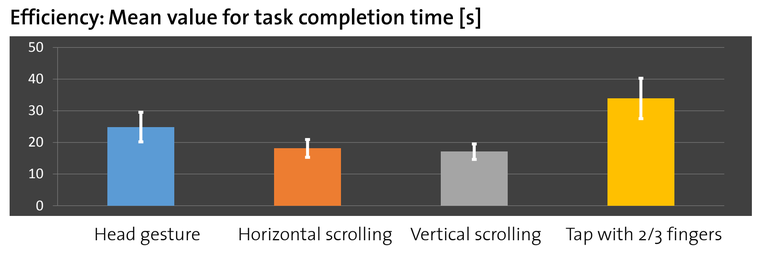
Evaluation criteria: Effectiveness, Efficiency and User Experience (Nasa TLX Workload and User Experience Questionnaire UEQ)

Results

ZOOM INPUT METHODS

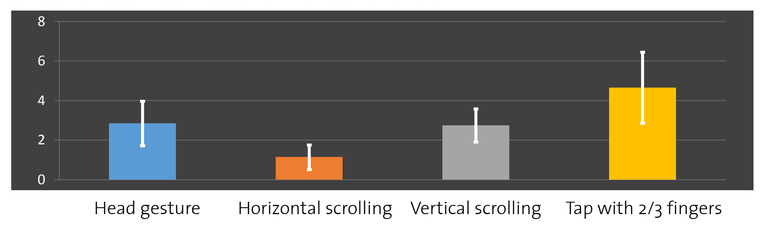
The zoom input methods 2 and 3 are signifycant more **efficient** than input methods 1 and 4.

Efficiency: Mean value for task completion time [s]



The zoom input method 2 is significant more **effective** than the other three input methods.

Effectiveness: Mean value for number of errors



Regarding the criteria **user experience** (UEQ, Nasa) the scrolling methods are significant more user friendly than input methods using head gesture and touchpad tap.

PAN INPUT METHODS

Between both pan input methods there is no significant difference regarding the criteria **efficiency** and **user experience**. However, input method head gesture is significant more **effective** than the touchpad scrolling method.

Effectiveness: Mean value for number of errors

Conclusions

For zooming interactions, scrolling horizontal (rank 1) and vertical (rank 2) are more user friendly input methods over all criteria. For pan interactions the differences between the input methods are small, but the head gesture method tends to be a bit more user friendly.

CHALLENGES

- Pan: Scrolling vertical without at the same time scrolling horizontal by mistake
- Zoom & Pan: Head gesture sensor very sensitive on temperature

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