A music player user interface based on head-gestures and 3D audio feedback

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1 Background

Music applications on smartphones makes listening to your favourite music very accessible and mobile. Although the possibility of listening to music at any time and place immediately seems like a positive development this could introduce other challenges. E.g. biking and controlling a music application will conflict in the sense that biking demands hands on the handlebars and eyes on the road, and a smartphone application demands hands (or at least one hand) and eyes for navigating resulting in an increase of the users cognitive load.

At the same time emerging accessories with built in sensor hardware e.g. Google Glass or Intelligent Headset (http://intelligentheadset.com/developer/) offer alternate ways of using gestures in form of GPS location, rotation, acceleration, speech etc.

Encouraged by the biking scenario challenge and todays emerging mobile technology - alternative ways of controlling a music application should be explored. In this project an alternative way of navigating using head gestures and audio feedback will be explored.

Contents

2 Introduction

Motivation : Use references to claim that using eyes and hands as interaction could be a potential problem in some scenarios or that it could be preferred to use eyes- and handsfree interaction model instead...

Pascoe et al. investigated HCI issues when people are on the move and trials showed that a vital factor was to minimize the amount of distraction for interaction modes [7].

Visual displays can be obtrusive and hard to use in bright daylight, plus they occupy the users' visual attention [4]

Short description of what and in which order this project will be executed. What is in the report?

3 Related work

Kajastila and Lokki has done a user study comparing auditory and visual menus controlled by the same free-hand gestures where the majority of the participants felt that an auditory circular menu was faster than a visual based menu [6].

Brewster et al. showed that novel interaction techniques based on sound and gesture can significantly improve the usability of a wearable device in particular under "eyes-free" mobile conditions and that head gestures was a successful interaction technique with egocentric sounds the most effective [1].

William W. Gaver, a pioneer in audio interfaces, has explored several aspects of using sound in interfaces including the intuitiveness of presenting complex information to users in the form of audio [3]. Similarly Graham explores the advantages in reaction time when using "auditory icons" [5]. In [2] Gaver presents the use of spatial sound icons. In doing so, he draws forward the unutilized potential of creating natural interaction through spatial audio.

4 Interaction design

4.1 Auditory menu

Several studies show that circular auditory menus are the way to go because of horizontally positioned sounds

4.2 Multimodal interaction

Research area in HCI (Human Computer Interaction)

4.3 3D audio feedback

HRTF, pilot example from pervasive project

4.4 Music player interaction design

Idea: Nod/shake -¿ yes/no reference (ref from Diako paper)

5 Implementation

5.1 NOTES

Milestones - POC:

1. Create and setup xcode project including lib references for Intelligent Headset and Spotify
2. Play a users Spotify songs and be able to use panning and volume
3. Place multiple songs in the horizontal range 0-180 degrees of the user using IHS rotation
4. Implement nodding and shaking feedback

Milestones - further improvements (dependent on user interaction feedback / research):

1. Exploring the Spotify lib/playlists
2. Activation of head gestures
3. Fine tuning

Learnings:

Streaming from Spotify to OpenAL could be difficult. It requires decompressing of the stream; 1) maybe not possible with libspotify, 2) If so very heavy - could affect user experience, 3) OpenAL restrictions

Idea (avoiding OpenAL's limited audio input properties):

As we only need horizontal 180 degrees we could use panning. Place x songs from 0-180 degrees. As the user rotates head a song pans in from the direction with increasing volume.

5.2 Application design

SDK's, APIs, Processing sensor data

6 Evaluation

6.1 NOTES

Iterations, measurable comparison between new system and traditional?

2 evaluations - closed lab (1 day) and open (real life, week(s))

Idea for closed lab exercise - Multiple lists of songs. A user shouls navigate and play the different songs with head gestures and normal navigation. Compare these in relation to time taken, cognitive load (eyes and at least one hand occupied), user feel of frustration (cognitive load) when navigating

Final evaluation:

Idea: Time to find a song, level of frustration (cognitive load) for finding song

NB: For final evaluation - device with 3G+ connection and added to apple developer team, should be executed latest mid of April so finished end of April (1/2 weeks trial), 2 testpersons -¿ 1 experienced tech person and 1 non-tech/average user

7 Discussion

Other scenarios e.g. visual impaired people, car driving

8 Conclusion

References

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