
Mobile Spatial Interaction

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Abstract

Mobile phones are starting to become the major platform for interaction with spatial information. Recent research has yielded promising applications and approaches for exploring, accessing and augmenting information related to the user's immediate surroundings. The CHI workshop "Mobile Spatial Interaction" (MSI) aims at gathering researchers working on this emerging and multifaceted, but quickly evolving topic. A forum for open dialogue is needed to enable researchers to obtain a picture of the facets and the benefits of mobile spatial interaction as well as its challenges. Potential ways to combine the various approaches will be examined and discussed.

Keywords

User Interaction, Orientation, Location Based Services, Augmented Reality, Mobile Computing, Context Aware computing.

ACM Classification Keywords

H.5 Information Interfaces and Presentation (I.7); H5.2 User Interfaces: User-Centered Design.

Introduction

The use of geo-referenced data has received increasing interest in the research community as well as in the public. Soon cities and landscapes will have their digital counterpart, which opens up many new application areas. Though services like Google Earth or Microsoft Windows Live Local are currently accessed over personal computers, mobile devices promise to be an

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even more suitable platform for interaction with geo-spatial information. Spatially aware handheld devices can serve as bridges between the real and virtual information space. The vision of a next generation of portable geographic information systems was being put forward by Egenhofer [5].

Mobile spatial interaction can *reach beyond* location. It can include cues about situation and orientation towards the surrounding environment. 3D models of the land- and cityscape can facilitate the identification of meaningful spatial objects – not just position coordinates. Recent HCI research has proposed interesting approaches on how to add a sense of orientation and space to mobile interaction. Four important areas of research into mobile spatial interaction and related significant contributions are:

Accessing information attached to physical places

Based on Egenhofer's ideas for mobile spatial interaction, Simon et al [14] presented a technical approach for selecting spatially anchored services ("points of interest"), based on location and orientation sensors attached to the mobile device. First commercial location and orientation aware services have meanwhile been started in Japan [8]. Camera phones can offer interesting possibilities to access information attached to places, based on image recognition and barcodes [13]. Up to now, no attempts towards the integration of these different spatial awareness concepts has been undertaken.

Navigation and Wayfinding

Orientation aware features in car navigation systems, such as the "flight mode" visualisation support efficient

wayfinding. Also for pedestrian navigation, the importance of orientation information has been acknowledged ([9], [15]). However, the exact benefits of concepts such as "egocentric presentation" vs. "north-fixed" orientation of maps still need to be clarified by empirical research (cf. [7]).

Adding content to physical places or objects

A number of projects such as GeoNotes [6], Urban Tapestries [10] or Riot! [12] are based on the concept of attaching digital information to real-world coordinates like a virtual post-it note or graffiti. Spatial context has also proved to be an interesting aspect in technology mediated communication, such as in group and public messaging [11]. The creation of geotagged content in communities like Flickr [3] opens up many possibilities for mobile users to experience spatially contextualized media. Arguably, these forms of end-user content creation will be more intensively used on mobile devices, if users are provided with a tangible and spatially consistent representation of their real environment.

Mobile virtual and augmented reality

Chittaro et al [4] enabled tourists to explore nearby attractions via the location-aware 3D-visualisation of a city. Adding 3D orientation sensors, Baillie et al [1] demonstrated a mobile tourist information system which served as a "window to the past" for a historical part of Vienna. The system enabled the users to navigate in time and space. The creation of virtual parallel worlds corresponding to the user's space is also a central component in pervasive gaming [2]. Augmented reality, the overlay of virtual information over the user's perspective on reality may be regarded

as one of the most promising approaches towards mobile spatial interaction. Smart concepts are needed that circumvent or even appropriate technical limitations for the application concept. What is missing today is a forum, let alone a common framework for mobile spatial interaction, in terms of interaction design, technical and spatial modeling and application scenarios.

Questions

Our workshop may help to realize the vision of seamless and intuitive Mobile Spatial Interaction. The goal is to *reach beyond* the conventional model of location by creating a sense of space and orientation. The workshop will take the first steps towards answering the following questions:

- What are the different **facets** of MSI? How do concepts such as environmental visibility, nearness, orientation, or panorama relate to each other?
- What are the **benefits** and application possibilities of MSI? How can they be structured?
- What are the **challenges** and limitations for MSI (technical, cognitive, societal, etc.)?
- What are the appropriate **approaches** for MSI? How can the facets, benefits and challenges be addressed in human-computer interaction and related disciplines?

Topics

- Methods and ideas for the identification of application scenarios
- Modeling concepts for geo-spatial (end-user) content creation

- Conceptual designs and scenarios of spatially-aware interaction techniques
- Outdoor testing methods for spatially aware applications
- Augmented/parallel reality concepts in gaming, arts, tourism, etc
- Location/orientation sensing technologies and migration paths from legacy to state-of-the-art technology
- Indoor navigation and spatial awareness
- Practicality and feasibility issues regarding technologies, application design and data modeling.
- Combination of spatial interaction with gesture-based interaction
- Dealing with sensor uncertainty e.g. how to deal with unreliable GPS reception or magnetic compass interference?
- Multimodal integration, e.g. by adding spatial audio, touch, or scent

Audience

The intention is to bring together researchers and practitioners from areas as diverse as: mobile application design; geographic information systems, geodesy and geoinformatics; interaction design; pervasive game design; communications theory and social software design; experimental hardware prototyping; commercial device manufacturing; psychology of spatial perception; semantic systems and natural language processing; marketing; usability; multimedia arts; tourism and cultural heritage; information visualization and sonification; augmented reality research, etc.

Format

The workshop will be organized as a 1-day event. Each selected contributor will get time to present their profiled statements and research results on mobile spatial interaction. The presentations and demos will be allocated to topic groups clustered from the submissions. During the presentations and demos, the other participants will try to extract and document "clues" for answering the 4 workshop questions on cards. These clues will be collected for discussion and consolidation at the end of each half day.

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References

- [1] Baillie L., Kunczier, H., Anegg, H. Rolling, Rotating and Imagining in a Virtual Mobile World. Proc Mobile HCI 2005.
- [2] Benford, S. et al. Bridging the Physical and Digital in Pervasive Gaming. Communications of the ACM. Vol. 48, issue 3 (2005) 54–57.
- [3] Butterfield, S. (2006). Geotagging - one day later. Flickr blog. Permalink: http://blog.flickr.com/flickrblog/2006/08/geotagging_one_.html
- [4] Chittaro L., Burigat S., Location-aware visualization of a 3D world to select tourist information on a mobile device, In the Proceedings of the 3rd International Workshop on HCI in Mobile Guides, Glasgow, UK, September 2004.
- [5] Egenhofer, M. J. Spatial Information Appliances: A Next Generation of Geographic Information Systems. 1st Brazilian Workshop on GeoInformatics, 1999.
- [6] Espinoza, F., Persson, P., Sandin, A., Nyström, H., Cacciatore. E., Bylund, M. GeoNotes: Social and Navigational Aspects of Location-Based Information Systems. Proc. Ubicomp 2001
- [7] Fröhlich, P., Simon, R., Baillie, L., and Anegg H. (2006). Comparing Conceptual Designs for Mobile Access to Geo-Spatial Information. To appear in: Proc Mobile HCI 2006
- [8] GeoVector. Online available at: <http://www.geovector.com>
- [9] Hermann, F., Bieber, G., and Duesterhoeft, A. Egocentric Maps on Mobile Devices. In the Proc. International Workshop on Mobile Computing, 2003.
- [10] Lane. G. Urban tapestries: Wireless networking, public authoring and social knowledge. Personal Ubiquitous Computing. July 2003. Vol. 7, no. 3-4.
- [11] Rantanen, M., Oulasvirta, A., Blom, J., Tiitta, S. & Mäntylä, M. 2004, Proc NordiCHI 2004
- [12] Reid, J., Hull, R., Cater, K., Clayton, B. "Riot! 1831: The design of a location based audio drama." Proc of UK-UbiNet 2004.
- [13] Rohs, M. Real-world interaction with camera-phones. Proc. UCS. IPSJ Press (2004).
- [14] Simon, R., Kunczier, H., Anegg, H. Towards Orientation-Aware Location Based Mobile Services. 3rd Symposium on LBS and TeleCartography, 2005
- [15] Wasinger, R., Stahl, C., Krüger, A., "M3I in a Pedestrian Navigation & Exploration System". Proc. MobileHCI 2003.