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Abstract

Mobile and wearable computing has great potential to support alpine outdoor sport activities. This includes, but is not limited to, rock climbing, hiking, mountain biking, paragliding, and skiing. Interestingly, technology for tracking, monitoring and supporting sport activities is broadly used in sports like running or cycling, but has not reached *the top of the mountains* yet. Nevertheless, such technologies could support people in many *mountain scenarios* such as activity tracking, navigation, or emergency support. Technologies and applications for mountaineers can learn from ubiquitous computing research in many ways to provide more joyful, motivating and safer outdoor experiences. This workshop addresses the promises and challenges that arise, when UbiComp technologies are applied to alpine activities. During this two day workshop the participants will present their positions and research, followed by a hands-on experience on current technology during a field trip.

Author Keywords

Alpine sports; outdoor activities; sports technologies; technology acceptance; activity tracking; wearable computing.

ACM Classification Keywords

H.1.2 [User/Machine Systems]: Human factors; H.5.m [Information interfaces and presentation (e.g., HCI)]: Miscellaneous.

Motivation

Mobile and wearable computing has great potential to support alpine outdoor sports (e.g. rock climbing, mountaineering, hiking, paragliding, mountain biking and cross-country or downhill skiing). Activities in the mountains depend on various factors (e.g. route difficulty, access, remoteness, and weather conditions) that require fitness, experience, and planning. The use of technology can be beneficial in numerous ways: It can be used as an assistive system for the mountaineer or climber (e.g. a digital instructor or a navigation aid), as an additional safety measure (e.g. a real-time weather monitor for paragliders), or as a training tool (e.g. an activity tracker for cross-country skiers).

Although sports like hiking, running and biking received a lot of attention in research, alpine sports were, to a certain extent, neglected. Some work exists that addresses sports tracking, assistive systems, games & play and training. There is a vast corpus on related work in the area of supporting people while navigating in outdoor enviroments e.g. as described in [8]. New interaction technology can be used to bring people to defined places to enjoy the same experiences [2] or to facilitate solitude by providing guidance on how to avoid other people [7]. Sports tracking [1], for example, has been suggested for climbing [4, 5, 6] and backcountry skiing [3]. The relation of performance and experience of sports watch usage has been studied in runners [9] indicating that wearable technology can improve both performance and the experience.

These examples show that several research groups in the UbiComp and HCI community already started to explore the challenges when applying technologies to mountain sports. In our workshop we want to bring them together for the first time. The Workshop on "Ubiquitous Computing in the Mountains" aims to provide an interactive forum to discuss the challenges that appear when UbiComp technologies are applied to activities in the mountains. Some of these challenges are finding a good balance between the beneficial use of technology without distracting the users from their nature experience, the application and adaption of already manifested interaction techniques to the mountaineering domain, or the design of unobtrusive body worn devices which do not hinder the user in pursuing their outdoor activities. We believe that the workshop is very interesting for the UbiComp community, since the results will also inform other application domains (e.g. ubiquitous computing in health and wellbeing).

Topics and Goals of the Workshop

Submissions for the workshop could address but are not limited to the following topics:

- Design & implementation of (ambient) assistive real-time systems and the adequate use of notifications
- Social acceptance of technology use in alpine activites
- Novel navigation systems, tailored for the special needs in mountaineering or climbing
- Systems that enable disabled or impaired people to pursue outdoor activities
- Emergency or quick response systems for e.g. mountain rescue
- Tools and methods for movement analysis
- Design and analysis of gamification components in climbing or mountaineering, e.g. for training or motivation
- Interaction techniques for motor skills learning
- Wearable computing technologies for mountaineers

This workshop aims to bring together researchers from academia and industry (e.g. sports technologies, tourism, natural resources) to discuss and share their research, experience and insight. We welcome participants working with user research, ethnography, design, prototyping, or evaluation and want to facilitate a multidisciplinary approach throughout the workshop.

As stated above, mountaineering and climbing is still in an early stage in the UbiComp and HCI community. The higher level goal of this workshop is to lay the foundation of a growing research community, pursuing UbiComp and HCI in the mountains. For this, the most important goal of this workshop is, 1) to gather together researchers who address the several factors in mountain acitivties in their work, to build a network among these people. The additional goals of this workshop are 2) to identify and discuss the challenges of current research and how to tackle them, and 3) promote the research of UbiComp technology usage in the mountains, and discuss the promises and risks related to the topic. Finally the workshop should 4) give hands on experience of current and future UbiComp technologies which can leverage the area of mountaineering and climbing.

Workshop Organization

Pre-Workshop Plan
The call for the workshop will be distributed in HCI and Ubi-Comp related emailing lists. A flyer will be designed and distributed at HCI venues, and we will advertise the workshop at e.g. CHI, NatureCHI, DIS, PerDis and among key research groups. The important dates associated with the workshop's organization are as follows:

- Distribution of CfP: May 5, 2016

- Submission deadline for workshop papers: June 3, 2016

- Notification of acceptance: June 24, 2016

- Deadline for camera ready version of research papers to include in the ACM DL: July 1, 2016

Workshop Structure
The workshop is organized as a two-day workshop. It will consist of workshop paper presentations, discussions, group exercises and an optional field trip to a climbing spot or a hike (depending on the the weather) in Heidelberg. On the first day the position papers of the participants are presented in a condensed format (max. 5 min). In preparation for the field trip on the second day the technologies provided by the organizers (including wearable technologies, 3D scanner and cameras, software systems, and also drones) are introduced. After forming groups, the participants get hands-on experience during group-projects with the provided technology. The first day concludes with a joint workshop dinner.

The field trip takes place in the "Riesenstein" area, a crag close to the old town of Heidelberg (approx. 30 min walk from the conference venue). During the field trip, the participants explore the technologies and projects they prepared on the first day while climbing, bouldering, or hiking. The aim of this field trip is to foster the creation of research ideas for future projects. In case of bad weather, the practical part could take place in the "Boulderhaus" Heidelberg, an indoor climbing gym or in the form of a hike in the hills around Heidelberg. After returning to the conference venue, the groups present their experiences of the field trip.

A lecture room for ca. 30 people is required for the workshop. The estimated number of workshop participants is around 12-18 people. Each participant will contribute to the workshop with a position or research paper (4 pages in CHI EA format). Research papers will be included in the ACM

digital library. Submissions should contain a distinct position on research or design work within the scope of ubiquitous mountaineering and climbing technologies. The submissions will be reviewed by the organizers and the workshop program committee. The selection of participants is based on the reviews. We are aiming for a good balance of different perspectives on the workshop topic.

Post-Workshop Plan
During the workshop we will collect data (e.g. raw sensor data, video footage of the field trip, feedback from the participants) that will be analyzed after the workshop. We will apply to have a summary article for the ACM Interactions Magazine. Futhermore, we will also reach out to the alpine sports community by writing an article for an alpine sports magazine. In this article we will present the current state of research, reflecting on the predictions parts of the workshop organizers made in 2007 (http://goo.gl/dYwy2x), and update our vision for mountaineering in the next decade.

Organizers' Backgrounds
Florian Daiber is a post-doctoral researcher at the German Research Center for Artificial Intelligence (DFKI). His main research is in the field of human-computer interaction, 3D user interfaces and wearable computing with a strong interest in wearable sports technologies.

Keith Cheverst is a reader with the School of Computing and Communications, Lancaster University. A significant focus of his research over the last 20 years has centered on the design and deployment of mobile systems that provide support for locative media experiences and wayfinding in both rural and urban settings.

Johannes Schöning is a professor of computer science at Hasselt University working at the Expertise centre for

Digital Media (EDM). His main research interests lie at the intersection between human-computer interaction (HCI), geographic information science and ubiquitous interface technologies.

Jonna Häkkilä is a professor at Faculty of Art and Design, University of Lapland. Her research interests include mobile and ubiquitous interaction and user experience design, and user studies in-the-wild. Currently she is working e.g. on using natural materials for tangible interactions and HCI in the nature.

Massimo Zancanaro is the head of the i3-Intelligent Interfaces and Interaction research unit at Fondazione Bruno Kessler (FBK). His primary interest is in the field of Intelligent Interfaces particularly in the area of co-located collaborative systems. He teaches Computer-Human Interaction and Graphical User Interfaces Programming at the University of Trento.

Frederik Wiehr & Felix Kosmalla are researchers at the DFKI and the founders of *climbtrack*, a startup aiming to create assistive technologies for climbing. With the *betaCube*, they recently won the Cebit Innovation Award 2016 (www.cebitaward.de). Their research is concerned about extracting higher-level information from sensors and devices to give individual meaningful assistance, enhancing learning and improving social interaction in sports.

Cassim Lahda is a bio-medical engineer with a strong interest and over 15 years experiance in technology development for both animal and human health applications. He is an invited associate researcher at Institute of Neuroscience, Newcastle University and CEO of a consulting thinktank, Cascom Ltd.

REFERENCES

1. Aino Ahtinen, Minna Isomursu, Ykä Huhtala, Jussi Kaasinen, Jukka Salminen, and Jonna Häkkilä. 2008. Tracking Outdoor Sports — User Experience Perspective. In *Proceedings of the European Conference on Ambient Intelligence (AmI '08)*. Springer-Verlag, Berlin, Heidelberg, 192–209. DOI: http://dx.doi.org/10.1007/978-3-540-89617-3_13

2. Keith Cheverst, Trien V. Do, and Dan Fitton. 2015. Supporting the Mobile In-situ Authoring of Locative Media in Rural Places: Design and Expert Evaluation of the SMAT App. *Int. J. Handheld Comput. Res.* 6, 1 (Jan. 2015), 1–19. DOI: http://dx.doi.org/10.4018/IJHCR.2015010101

3. Anton Fedosov and Marc Langheinrich. 2015. From Start to Finish: Understanding Group Sharing Behavior in a Backcountry Skiing Community. In *Proceedings of the 17th International Conference on Human-Computer Interaction with Mobile Devices and Services Adjunct (MobileHCI '15)*. ACM, New York, NY, USA, 758–765. DOI:http://dx.doi.org/10.1145/2786567.2793698

4. Raine Kajastila and Perttu Hämäläinen. 2014. Augmented Climbing: Interacting with Projected Graphics on a Climbing Wall. In *CHI '14 Extended Abstracts on Human Factors in Computing Systems (CHI EA '14)*. ACM, New York, NY, USA, 1279–1284. DOI:http://dx.doi.org/10.1145/2559206.2581139

5. Felix Kosmalla, Florian Daiber, and Antonio Krüger. 2015. ClimbSense: Automatic Climbing Route Recognition Using Wrist-worn Inertia Measurement Units. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems (CHI '15)*. ACM, New York, NY, USA, 2033–2042. DOI: http://dx.doi.org/10.1145/2702123.2702311

6. Cassim Ladha, Nils Y. Hammerla, Patrick Olivier, and Thomas Plötz. 2013. ClimbAX: Skill Assessment for Climbing Enthusiasts. In *Proceedings of the 2013 ACM International Joint Conference on Pervasive and Ubiquitous Computing (UbiComp '13)*. ACM, 235–244. DOI:http://dx.doi.org/10.1145/2493432.2493492

7. Maaret Posti, Johannes Schöning, and Jonna Häkkilä. 2014. Unexpected Journeys with the HOBBIT: The Design and Evaluation of an Asocial Hiking App. In *Proceedings of the 2014 Conference on Designing Interactive Systems (DIS '14)*. ACM, New York, NY, USA, 637–646. DOI: http://dx.doi.org/10.1145/2598510.2598592

8. Johannes Schöning, Antonio Krüger, Keith Cheverst, Michael Rohs, Markus Löchtefeld, and Faisal Taher. 2009. PhotoMap: Using Spontaneously Taken Images of Public Maps for Pedestrian Navigation Tasks on Mobile Devices. In *Proceedings of the 11th International Conference on Human-Computer Interaction with Mobile Devices and Services (MobileHCI '09)*. ACM, New York, NY, USA, Article 14, 10 pages. DOI: http://dx.doi.org/10.1145/1613858.1613876

9. Jakob Tholander and Stina Nylander. 2015. Snot, Sweat, Pain, Mud, and Snow: Performance and Experience in the Use of Sports Watches. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems (CHI '15)*. ACM, New York, NY, USA, 2913–2922. DOI: http://dx.doi.org/10.1145/2702123.2702482