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Wearable Technologies for Automotive User Interfaces: Danger or Opportunity?

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Abstract

Wearable technologies are spreading into human's everyday life. Smart bracelets, watches and glasses promise to provide us with ready-at-hand access to several information and interaction possibilities. What happens when these technologies enter the car? Are they a mere danger or can also offer information and interaction opportunities that can improve the vehicle inhabitants' user experience and safety? This workshop aims to discuss all the opportunities and dangers that such technologies not only are already bringing in nowadays vehicles, but could also bring in future semi-autonomous and autonomous vehicles.

Author Keywords

Wearable technology; automotive user interface; in-vehicle interaction

ACM Classification Keywords

H.m. [Information Systems]: MISCELLANEOUS; K.m. [Computing Milieux]: MISCELLANEOUS.

Introduction

Smartphones brought ubiquitous computing to the mass and more and more people are now bracing the "always connected" lifestyle. At the same time, the

wearable technology began to spread and currently smart watches and bracelets are becoming pervasive. This need of being always connected is difficult to stop while traveling, an activity that occupies a consistent part of human life; driving is often necessary while traveling and this activity can consistently reduce the interaction possibility of the driver, because of safety concerns. While several in-vehicle commercial systems already exist to reduce distraction and sensorimotor impairment caused by the handheld usage of smartphones (typically based on voice interaction), most of the personal wearable device usage is left without control in the car. Neither regulations nor systems that can reduce the risks due to their usage while driving exist. Nevertheless, personal devices can be also important resources for driver-vehicle interfaces [1]. Bracelets like Empatica [2] or the popular Motorola MOTOACTV [3] are able to monitor important physiological signals, namely galvanic skin response and heart rate, which can be exploited by the car to understand the driver psychophysiological status. For instance, recent studies demonstrate the possibility of using these physiological signals as indicators for the driver's workload [4]. In turn, information on the driver status can be exploited by a semiautonomous vehicle to adapt the Driver-Vehicle interface and possibly change the driving modality, from manual to automated control as implemented in the HAVEit project [5]. Besides physiological signals for the driver monitoring, wearable devices offer input and output capabilities that go beyond the car resources: gestures can be easily recognized with the accelerometer of a smart bracelet, or with electromyography based devices [6][7]. Smart glasses can provide visual feedback within the head [8] or the eye reference frame through opportune eye tracking [9]. Haptic feedback is possible through smart

watch vibrations [10] or actuators integrated in the clothes [11]. Another interesting opportunity is the opportunistic coupling between a wearable interface and the vehicle system in order to enhance the user experience [12].

Goals and Topics of Interest

This workshop aims at leveraging the discussion about an emerging topic in Automotive User Interfaces. The discussion aims at identifying the main risks coming from using wearable technologies while driving but also the potential benefits that wearable devices can offer in different driving conditions.

The workshop major topics comprehend and are not limited to:

- Wearable head-up displays
- Smart watches and bracelets
- Smart textiles
- Wearable physiological sensors
- Wearable haptic actuators
- Wearable interfaces for semi-autonomous and autonomous driving
- Integration approaches
- UX with wearables for drivers and passengers
- In-vehicle interaction design with wearable

Schedule

The initial planned schedule is the following:

June 30th, 2014: Publication and distribution of the call of papers with relative website.

July 30th, 2014: Submission deadline for the workshop papers.

August 10th, 2014: Notification of acceptance for the submitted workshop papers.

September 17, 2014: Half-day Workshop.

Structure

During the first part of the morning, each participant will present his/her workshop paper, followed by a short discussion; in the second part of the morning, a discussion session will be held aiming at sorting out identified challenges and opportunities; therefore, the attendees will work in order to set up the multi-disciplinary research agenda for further collaboration that will hopefully lead to international projects. The afternoon will be dedicated to hands-on activity: the participants will design new interfaces that can integrate the wearable technology in automotive interfaces; a first prototype will be developed in order to understand the practical challenges related to this concept. In order to help developing the prototype, the organizers will bring some wearable devices such as the Pebble smart watch [10], an Empatica bracelet [2], a Google Glass [8] and smart textiles. This activity may be further developed in collaboration between the participants, hopefully leading to new research investigations and publications.

Audience

This workshop addresses people coming from both the academia and the industry. It aims at bringing together researchers from different domains, such as design, cognitive psychology, engineering, ergonomics and human factors.

Preliminary studies or position papers will be accepted but not required to participate in the workshop. Accepted papers and the relative presentations will be published in the workshop website. Interested participants will be requested to submit a brief paragraph of the participant's background and topic of interest. Participants will be selected through a blind review process by a selected program committee with expertise in the automotive domain to insure a multidisciplinary group that will be motivated to start an interesting debate about this topic. This workshop aims at bringing together about 15 participants.

Publicizing

A website for the workshop will be created with detailed information for participants including notes, materials, results, and photo-reportage from the workshop. Email invites will be sent to specific individuals, groups and mailing lists. The event will be spread in the social media too, with live reportage during the event.

Moreover, the same organizers will hold the Atelier of Smart Garments and Accessories workshop at the UbiComp and ISWC 2014 conferences; this offers an important opportunity to publicize the workshop since these conferences will be held in the same location and in the same week of AutomotiveUI conference.

Expected Outcomes

An expected outcome for the first part of the workshop, i.e., paper presentations and the subsequent discussion, is a summary of dangers and opportunities generated by the usage of wearable technologies for automotive user interfaces. The outcome of the second part of the workshop is a practical example on how to

integrate intelligently wearable technologies in an automotive user interface.

As long-term outcomes, we expect the formation of a new community interested in wearable technologies in the broader Automotive UI community, with adepts from both academia and industry. We hope that in the future the proper design of wearable-aware automotive user interfaces will improve the user experience in the car while increasing safety on the roads.

Organizers Biographies

Maurizio Caon is currently a PhD student in cooperation between the University of Applied Sciences and Arts Western Switzerland (CH), and the University of Bedfordshire (UK). He holds a BSc in Computer Science and Electronics Engineering and an MSc in Computer Science and Telecommunications Engineering from the University of Perugia, Italy. His research domains are in the area of computer science: Activity Recognition, Gesture Recognition, Context-Aware Ambient Intelligence and Human-Computer Interaction.

Leonardo Angelini is currently a PhD student in cooperation between the University of Applied Sciences and Arts Western Switzerland (CH), and the University of Fribourg (CH). He holds a BSc in Computer Science and Electronics Engineering and an MSc in Computer Science and Telecommunications Engineering from the University of Perugia, Italy. His research domains are in the area of computer science: Tangible Interaction, Gestural Interaction, Context-Aware Ambient Intelligence and Affective Computing.

Paolo Perego is currently research fellow and PhD student at the Politecnico di Milano in Italy. He is also

R&D System Manager at the ComfTech SRL, which is a company producing wearable technology for the unobtrusive measurement of physiological parameters. He holds an MSc in Biomedical Engineering issued by Politecnico di Milano in 2008. He is particularly interested in hardware and software development for wearable devices and brain-computer interface systems.

Giuseppe Andreoni received the Laurea Degree in Electronic Engineering in 1993 and the PhD in Biomedical Engineering in 1998 at the Politecnico di Milano, where he is assistant professor at the Industrial Design Faculty and Department. Currently, he is director on the Campus Point, and at the same time he is the coordinator of the Sensibilab (Biomedical Sensors and Systems Lab.) and of the LyPhE (Laboratory of Physical Ergonomics) at the INDACO (Industrial Design, Art, Communication and fashion) Dept. of the Politecnico di Milano.

Michele Tagliabue was trained at the Polytechnic University of Milan. In 2003 he was selected by the Inter-Polytechnic School for its international PhD program in Biomedical and Biomechanical engineering. His PhD thesis focused on human sensorimotor control. He worked in various Universities: University of Bourgogne, France; Polytechnic University of Milan, Italy; OHSU, Portland, US; MIT, Cambridge, US. In 2006 he earned a grant from the French Space Agency to study human multisensory integration. Currently he has a research position at Paris Descartes University.

Elena Mugellini is Professor at the Information and Communication Department of the University of Applied Sciences and Arts Western Switzerland. She is the

leader of the HumanTech institute (former MISG research group). She is also member of the Telematics Technology Laboratory at the University of Florence. She holds a PhD in Telematics and Information Society received from the University of Florence in 2006, and a Master in Telecommunication Engineering from the same university received in 2002. Her current research interests are on the areas of Ambient Intelligence, Multimodal Interaction, Tangible User Interface, Personal Information Management, Document Engineering.

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