EyeWear 2019: Third Workshop on EyeWear Computing - Focus: Social Interactions

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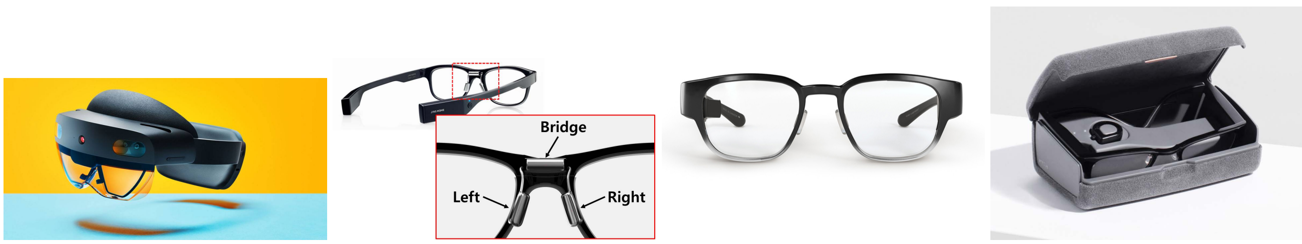

Figure 1: Examples of commercial Smart Eyewear. Microsoft Hololense 2, J!NS MEME, Focals by North, Focals in battery case

ABSTRACT

Computing devices worn on the human body have a long history in academic and industrial research, most importantly in wearable computing, mobile eye tracking, and mobile mixed and augmented reality. As humans receive most of their sensory input via the head, it is a very interesting body location for simultaneous sensing and interaction as well as cognitive assistance. Eyewear Computing devices have recently emerged as commercial products and can provide an research platform for a range of fields, including human-computer interaction, ubiquitous computing, pervasive sensing, psychology and social sciences. The proposed workshop will bring together researchers from a wide range of disciplines, such as mobile and ubiquitous computing, eye tracking, optics, computer vision, human vision and perception, usability, as well as systems research. This year it will also bring in researchers from psychology, with a focus on the social and interpersonal aspects of eyewear technology. The workshop is a continuation from 2016/2018 and will focus on discussing application scenarios as well as focusing on eyewear sensing and supporting social interactions.

CCS CONCEPTS

• **Computer systems organization → Embedded systems**.

KEYWORDS

smart eyewear, eyewear computing, augmented reality, sensing, context

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1 INTRODUCTION

The face is the main way in which we express personality and character, and is crucial to our ability to interact socially. It holds most of our senses - sight, hearing, taste, smell - and through nonverbal gestures, like facial affect and eye gaze, it allows us to communicate with others. Head and face are an obvious choice to place sensors and actuators to track activities, enable new user interactions, and study social interactions [1, 6].

For a long time, head- and face-based wearables have been restricted to special purpose, niche applications. While hearing aids and mobile headsets are widely accepted as head-worn devices, users in public spaces often consider novel head-attached sensors and devices as uncomfortable, irritating, or stigmatizing. Yet, given a number of recent technological developments, we believe eyewear computing will soon transition into mainstream technology and become a prominent research field. In essence, because the face is so important to humans, under every day circumstances people are highly sensitive to ergonomic and social acceptance aspects of anything placed there. It is telling that in early wearable computing ergonomic studies the head was not even included [2]. Early egocentric vision devices were rather bulky, expensive, and their battery

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life severely limited their usage [4]. Building on existing work in wearable computing, recent commercial egocentric vision devices and mobile eye trackers, such as Google Glass, SMI ETG, and J!NS meme, pave the way for a new generation of "Smart Eyewear" that is light-weight, low-power, convenient to use, and increasingly looks like ordinary glasses adding to its unobtrusiveness [3, 5, 8].

This workshop is motivated by the observation that, through a combination of consumer attitude shifts and technological advances, complex head/face-based sensing/interaction is becoming more feasible for use in every-day situations, and across multiple users. Recently, eyewear computing has begun to move towards commercial applications with viable products (see Figure 1). Advances in real-life tracking of physical and cognitive activities and states (e.g. reading, walking, detection of fatigue, cognitive load) enable applications on areas like quantified self for the mind [7, 8]. And with increasing ubiquity of the technology, new opportunities arise for applications that track social behaviours and interactions between groups of people in real-world settings [9]. The workshop is a continuation of the first two EyeWear workshops at UbiComp (2016 in Heidelberg, and 2018 in Singapore). These two workshops focused mostly on enabling technology. We will still discuss enabling sensors and actuators, yet in contrast to 2016/2018, we will focus more on application scenarios and creating the academic and corporate connections for an open eyewear platform to foster exchanges in sensing, interaction, hardware and software know-how.

2 TOPICS

As Smart Eyewear can be a powerful enabling technology for a broad range of research fields, we plan to tackle the following topics during the seminar with a special focus on forming a community to exchange hardware designs, requirements, best practices and source code to build and run Smart Eyewear prototypes. The areas of interest include:

Novel application cases: Which activities are the most useful for application cases that have the most impact on society. What are the best application fields to apply Smart Eyewear for the strongest social impact?

Suitable Sensing and actuation technologies: Driven by the application cases, which sensing modalities are the most interesting to be integrated in Smart Eyewear? What are the important activities and measures to focus on (e.g. fatigue detection, concentration tracking)?

Impact and perils of long-term sensing: How can we use these real life recordings of physical, physiological and cognitive signals on the head? What are potential negative effects of long term usage, ranging from perceptual issues regarding the use of wearable displays to potential skin irritations during the deployment of electrodes or other sensors necessary to touch the skin.

Towards an Open Eyewear Platform: How can we build up an international community to share scientific results and work together on topics related to Smart Eyewear. Especially large scale, long-term monitoring of cognitive capacities, promises to have a strong impact on psychology, sociology, and cognitive science. Eyewear computing can be an enabling technology to transform these domains from model- to rather data-driven sciences utilizing real world setups instead of controlled laboratory settings.

3 ACTIVITIES

We propose a one-day workshop **on the 9th September** with presentation sessions in the morning, development of scenarios in the early afternoon, and group discussions on fundamental challenges in the late afternoon. In the following we describe pre-workshop preparations and the post-workshop follow up.

3.1 Presentations

The workshop will start with an introduction and the keynote to the workshop topic (10:00-12:30), followed by short introductory presentations to get familiar with the participants and the topics they are working on. A keynote will be given by Daniel C. Richardson. Daniel is Professor of Experimental Psychology at University College London (UCL), where he heads up the EyeThink lab. He researches the social grounding of many cognitive processes, with a particular expertise on the role of gaze. Authors will get 5 minutes to present their work keeping presentations short and focused. While listening to the presentations, all participants will be asked to take notes on provided Post-Its, which we will share on a large whiteboard in order to prepare for the discussion sessions. The presentation session will be broken into two parts with a short coffee break in between. This will allow enough time to discuss different ideas coming out from the presentations.

3.2 Demonstration Session

We encourage participants to demonstrate research prototypes related to their submissions. Depending on the number of demonstrations we will hold a separate session or do small show-and-tells in the coffee breaks.

3.3 Scenario Development

After the presentations, grouped participants will develop new scenarios. All participants will write notes on Post-Its, which will be added to the Post-Its from the morning session on the whiteboard. In order to sort out the challenges and opportunities for an Open Eyewear Platform, we will create an affinity diagram analysis of the Post-Its. Group analysis will start at 15:00 and will end at 15:30.

3.4 Group Discussion

After the group analysis, we will have a longer coffee break (15:30-16:00) followed by a discussion round on identified challenges and opportunities (16:00-17:00). Organizers will actively engage with the audience to stimulate discussions. We will summarize the key experiences from the workshop and will plan follow up activities (17:00-17:30).

3.5 Post-Workshop Follow Up

Organizers will document the outcome of the above analysis, and make this information available to the all participants through a shared Google Drive folder. Participants will be invited to an existing Slack channel where they can share papers relevant to the workshop themes.

4 ORGANIZERS

Benjamin Tag is an early carrier researcher at the Keio University Graduate School of Media Design. His work focuses on cognitive state assessments through monitoring physiological signals on the face. He works on Smart Eyewear with a focus on fatigue and cognitive load detection in everyday situations and on creating feedback loops for responsive media using head worn sensing.

Jamie A Ward is a lecturer at Goldsmiths, University of London. He works on wearable computing, with contributions to topics like activity recognition, performance evaluation, and applications to real-world problems in health, industry, and the arts.

Yuji Uema is a researcher at JINS Inc., where he develops smart eyewear and conducts feasibility studies with special focus on HCI, education and medical application. His Ph.D. research at The University of Tokyo includes the analysis and estimation of cognitive load based on eye blinks and eye movement.

Kai Kunze is a Professor at Keio University Graduate School of Media Design. His major research contributions are in pervasive computing with a focus on augmenting human abilities

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