MEME – Smart Glasses to Promote Healthy Habits for Knowledge Workers

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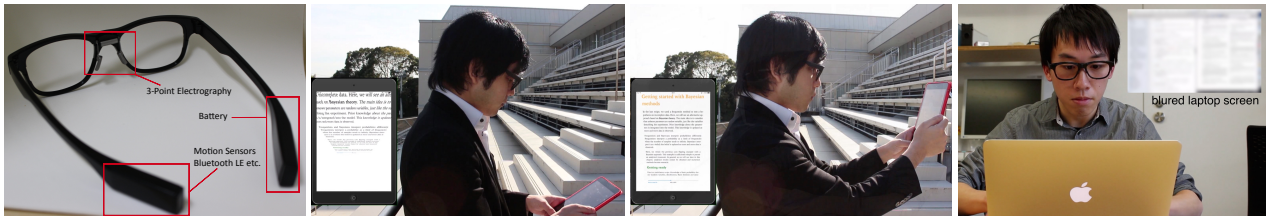

Figure 1: *J!NS MEME prototype (Fig a) and application cases in ergonomics(Fig b-d). We detect bad head posture using the glasses and translates the on screen content according to the bad head posture (Fig. b), until the user changes to a better viewing poition (Fig. c). If a user does not blink often enough the screen becomes blured (Fig d).*

1 Introduction

As people use computing devices more and more -not only desktops and laptops but also smart phones and tablets- related health risks also increase. Two of the most common and severe issues related to computer work are (1) the computer vision syndrome (CVS), symptoms include eye fatigue, headaches, dry eyes, blurred vision and (2) a too steep head flexion angle often referred to as "Text-Neck" leading to headaches and in extreme cases to spinal insures. According to medical research, users should blink often and in regular intervals (2-5 seconds) to prevent eye fatigue, dry eyes and ultimately the computer vision syndrome. To prevent "Text Neck", related work suggests that the user's head should not have a flexion angle of larger than 60°for over a minute.

We propose the use of our prototype smart glasses to monitor and prevent unhealthy working habits related to both issues. The glasses can detect eye movements and blinks both using a 3 point electrode setup as well as head motions using accelerometer and gyroscope. We also design interactions to prevent the knowledge worker from bad habits related to CVS and Text-Neck.

2 Prototype

We present an early J!NS MEME prototype, sensing eye glasses able to detect head and eye movements [Ishimaru et al. 2015]. We implement our demonstrations with a J!NS MEME prototype shown in Figure 1. The prototype is unobtrusive and looks close to normal glasses. It is equipped with 3 electrodes (electrooculography) around the nose to detect eye movements and motion sensors (accelerometer and gyroscope) to detect head movement, as well as a Bluetooth LE module to stream the data to a PC, laptop, smartphone or tablet. The electrodes are sampled with over 100 Hz, the motion sensor with over 50 Hz. The prototype already has a battery runtime of over 8 hours while streaming sensor data (will be improved). The glasses weigh 32 grams. The glasses don't do any advanced processing of the sensor data, the application logic is implemented on laptop, tablets or smart phones.

3 Application Cases

To prevent computer vision syndrome, our system detects if a user is not blinking for a given period of time (8 sec. in the demo system), in this case the system starts blurring the screen of the computing device until the user blinks.

To help against unhealthy head posture, we estimate the head angle using the motion sensors in the glasses. If the angle is larger than 60°for longer than 40 sec., we perform a transformation of the screen content according to the necessary angle adjustment angle for mobile devices (e.g. smart phone or tablet), see Figure 1. We then track the head angle and mobile device movement (with the build-in accelerometer). The user can only continue watching the screen content after he adjusted his head to a better angle. For stationary devices we move the whole screen content upwards until the user returns to a good head posture.

Overall we believe that improving the ergonomics while working on computing devices is a perfect use case for smart glasses. In the last years, it became popular for people with normal eyesight to wear "computer glasses" for filtering blue light. Of course, we can use the glasses for other activities as well. We already presented work on how to use them for tracking reading activities and to perform simple eye gestures for computer interactions.

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