AirSpec: A Smart Glasses Platform, Tailored for Research in the Built Environment

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ABSTRACT

AirSpec is an extensible, environment-focused, research and development smart glasses platform that evolved from an existing open-source, psychophysiological monitoring system. We created custom supporting software toolkits that allow users to interact with the device, easily view real-time data, and perform remote data collection. In its base configuration, the system includes a variety of sensors that sample physiological and environmental signals and stream that data to a Bluetooth-connected client, either a phone running the AirSpec App or a Bluetooth-equipped computer via our website or a python script. In addition, AirSpecs have been made more extensible with multiple external electrical connections to support more applications and future sensor subsystems.

KEYWORDS

Platforms, Toolkits, Control Systems, Wearables, Smart Glasses, Across-Context Sensing, Environmental Monitoring

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1 OVERVIEW

When trying to get accurate environmental sensor measurements to relate to a user's perception or exposure, smart glasses are an attractive option, given that they are positioned where measuring these values often matter, i.e., near the eyes and ears where we visually and aurally perceive, and the mouth and nose where contaminants are inhaled and exhaled. Therefor, we augmented the prior Captivates [1] system, an open-source, psychophysiological-focused, smart glasses platform, which prioritizes users' physical and social comfort in its design. The original Captivates system focused on extensibility, physiological monitoring, and open-source development. Our new device includes a redesigned sensor suite with an environmental monitoring focus, and a toolset for prototyping and software development. We have added multi-spectrum light, ambient temperature and humidity, and gas sensing to the nose bridge of the glasses (Figure 1) and onto the sides while also upgrading the original sensor suite with more accurate and readily available sensor variants. For the face temperature sensing, we improved the original design by also including two additional contact-less temperature sensors to increase the accuracy of the readings across different head sizes. We call this new platform (including a sensor suite and accompanying software that tailor to the needs of environmental health and human comfort researchers) "Airspecs".

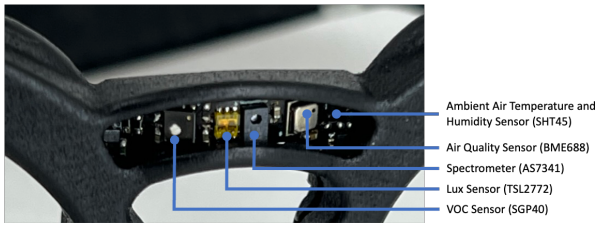

Figure 1: Detailed view of the environmental sensor addition to AirSpecs on the nose bridge.

We have partnered with labs in central Europe and South East Asia to run longitudinal studies to understand human comfort in built environments across various climatic regions throughout 2023; we have made 20 AirSpecs to be used for this effort. AirSpec has also been used as an environmental sensing device to reflect a plant's "comfort" level based on proximal environmental conditions to enable Human Plant Interaction (HPI) together with interactive, affective wearable garments and FlowIO [2].

REFERENCES

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