Cardiolens: Remote Physiological Monitoring in a Mixed Reality Environment

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Figure 1: Cardiolens is a physiological measurement tool that allows real-time visualization of vital signs in a mixed reality environment. i) Summary of the Cardiolens system. ii) An example of the experience from the perspective of the wearer.

ABSTRACT
Numerous vital signs can be captured through the measurement of blood flow; however, these signals are not visible to the unaided eye and measurement traditionally requires customized contact sensors. We present Cardiolens - a mixed reality application that enables real-time hands-free measurement and visualization of blood flow and vital signs. The system combines a front-facing camera, remote imaging photoplethysmography software and a heads up display allowing users to view the physiological state of a person simply by looking at them. Cardiolens provides the wearer with a new way to understand physiology and has applications in health care and affective computing.

CCS CONCEPTS
- Computing methodologies → Computational photography;

KEYWORDS
Health, Augmented reality, Mixed reality, Non-contact

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We place this image in the mixed reality space at the average distance of the user from the device (approximately one-meter). We compute the position of the captured frame in the 3D environment. We augment the appearance of the subject with the blood flow signal that would otherwise be imperceptible. Finally, the pulse wave for a 15-second window can be displayed below the subject’s face (this display option can be controlled via a simple “air tap” gesture). Figure 2 shows a screenshot of the actual visualization through the Hololens, captured using our demo application.

3 INTERACTION

Each user will be able to interact with Cardiolens. When they wear the Hololens the user will see a box displayed around the face of the closest person that they look at. After looking at someone for 15 seconds the heart rate and pulse wave will be displayed next to the face box and the magnified pulse signal superimposed onto the skin. The measurements will be updated continuously until the user looks away from the individual. We will have a traditional contact sensor on hand for users to compare the Cardiolens heart rate with that from a gold-standard device.

4 APPLICATIONS

The option of remotely monitoring peripheral blood flow and vital signs with a real-time mixed reality visualization has promise for improving many HCI systems in healthcare and affective computing. Visualizing blood flow in different parts of the body in real-time would be useful for surgeons in an operating theatre. Understanding changes in heart rate and heart rate variability would allow a speaker to gain insight on the cognitive load their audience is experiencing. Cardiolens is intended to help people understand physiological changes. There are ethical and privacy questions related to a device that can measure and visualize the physiological responses of another person. We hope that this demo also spurs debate about these issues.

5 CONCLUSIONS

We present Cardiolens the first mixed reality physiological monitoring tool that allows real-time remote measurement and hands-free visualization of vital signs and blood flow. Employing recent advances in computer vision, the system allows users to view normally imperceptible physiological signals in real-time by simply looking at the people around them.

REFERENCES


