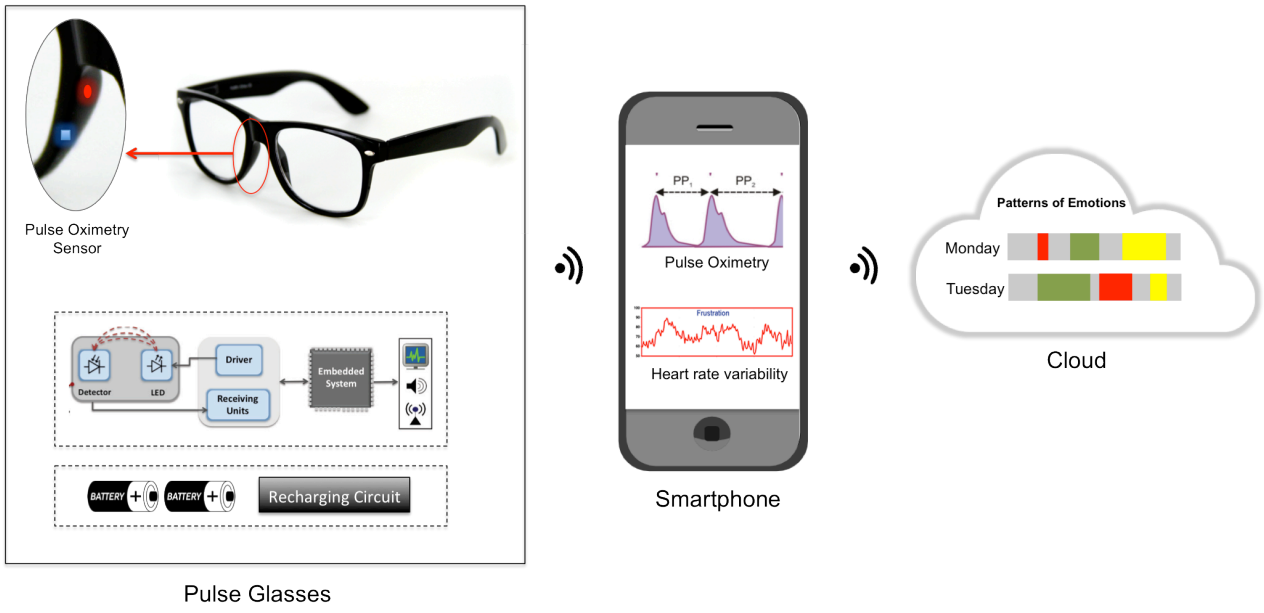
Pulse-Glasses: A Cloud-Connected Wearable Sensor for Monitoring Emotions

OVERVIEW:

Emotions are an extremely vital part of our lives, and they profoundly affect our actions, even though we're not always aware of them. Prolonged lack of emotion regulation may lead to psychiatric or behavioral disorders. Therefore, there is a growing interest in creating wearable technologies that can provide qualified information of emotions in daily life for various applications in mental health, behavioral interventions, sports, and many other aspects of well-being. Heart rate variability (HRV), which is a measure of beat-to-beat temporal changes in the heart rate, is associated with emotions since Autonomic Nervous System (ANS) function can be indexed by HRV. HRV can be derived from either electrocardiogram (ECG) or pulse oximetry. Pulse Glasses is a wearable device encapsulating pulse oximetry sensor to perform continuous HRV monitoring and allows individuals to log their emotions unobtrusively by forming close-range communication (e.g., bluetooth) with cloud-connected smartphones.

Pulse Glasses will be built upon cutting edge technologies involving wearable sensor design, embedded systems, and mobile cloud computing (MCC). This project falls into the category of "INTERNET OF THINGS (IoT)", buzzword widely used in industries today.

SYSTEM:



TEAM DESCRIPTION:

- One electrical engineer (for pulse oximetry sensor), one electrical/computer engineer (for embedded systems), and one computer engineer (for smartphone-based MCC)
- Passionate, get-things-done kind of drive, independent thinkers, and collaborative
- Pulse Oximetry Sensor: Strong interest in designing sensor analog hardware. PCB layout experience is needed.
- Embedded Systems: Thinking beyond arduino is required.
- MCC: Android-smartphone programming skills. Knowledge of client-server communication is plus.
- The team: All of the members will learn to use a 3D printer for creating Pulse Glasses prototypes that allow encapsulation of the pulse oximetry sensor.

DELIVERABLES:

Analog Circuit Board:

- Pulse sensor with infrared (IR) and near-infrared (NIR) LED-drivers
- Receiving unit with transimpedance amplifier, ambient noise cancellation, and A-to-D converter.

Embedded Systems Circuit:

- Embedded development board (gumstrix or raspberry pi) for data collection and signal processing of pulse oximetry and HRV
- Bluetooth communication for exchanging the data with smartphones
- Power management circuit with battery backup

Mobile Cloud Computing:

- Android programming for Bluetooth listener activity and temporary storage
- Communicating the data to the remote server (cloud) for data storage
- Smartphone interfaces visualizing the patterns of emotions.

"Life is either a daring adventure or nothing at all." – Helen Keller

For questions and concerns, please feel free to contact Dr. Kunal Mankodiya via email: kunalm@ele.uri.edu.