Wearable Biofeedback Monitor

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Purpose

Develop a wearable device designed to be worn on or around the facial region, specifically around the head or neck, to measure and monitor the user's vitals.

Project Requirements

Research and develop optimal sensor/location combination to measure:

- Heart rate
- Respiration rate
- Skin temperature
- Motion

Research and Testing

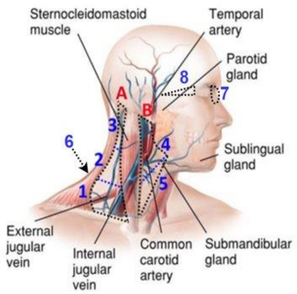


Figure 1. *Sensor placement based on major blood vessels*

Testing procedure: 3 people, 8 locations, 40 logs

Baseline: stethoscope, pulse oximeter

Testing condition: lab environment with sound noise

Sensors: photoplethysmogram (PPG), contact microphone, audio microphone

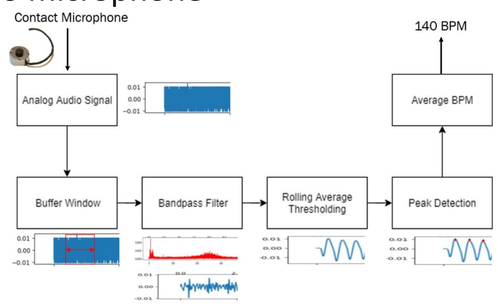


Figure 2. *Contact microphone filtering process*

Results

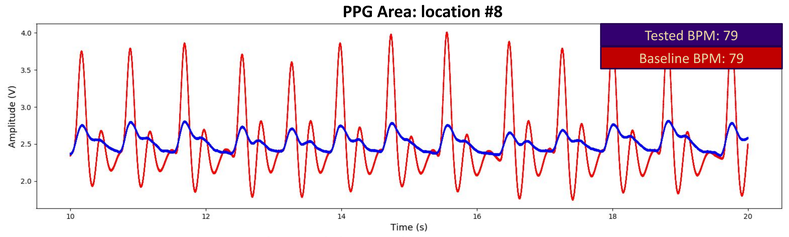


Figure 3. Tested and baseline PPG measurements at the selected location: nose bridge

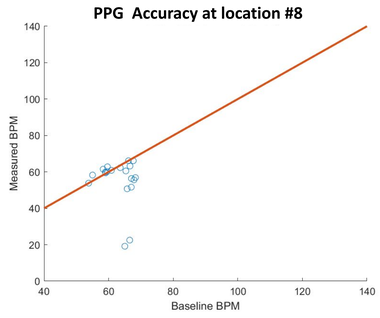
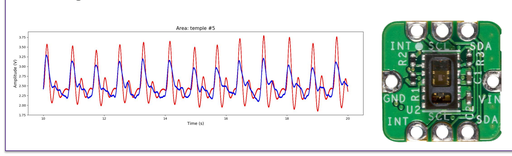


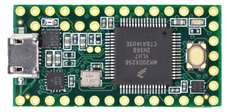
Figure 4. *Accuracy of the measurement at the nose bridge*

Final Design

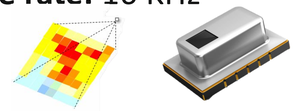
Sensor: Reflective PPG
Output: Pulse
Sample rate: 100 Hz



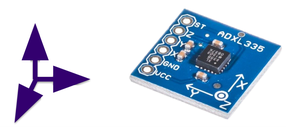
Processor: Teensy 3.2
Speed: 72 MHz
Power consumption: 22mW



Sensor: Infrared 8x8 Array
Output: Skin temperature
Sample rate: 16 KHz



Sensor: Accelerometer
Output: Orientation
Sample rate: 100 Hz



Bluetooth: BLE SMiRF
Output: Wireless communication
Rate: 2.4 GHz

Sensor: MEMs Microphone
Output: Breath rate
Sample rate: 16 KHz

Battery: 2 x Lithium coin
Capacity: CR2032