2017

Wearable Device to Detect Cardiac Arrest

Jon Dyke
Virginia Commonwealth University

Majid Alashari
Virginia Commonwealth University

Ashraf Al Gumaei
Virginia Commonwealth University

Wearable Device to Detect Cardiac Arrest

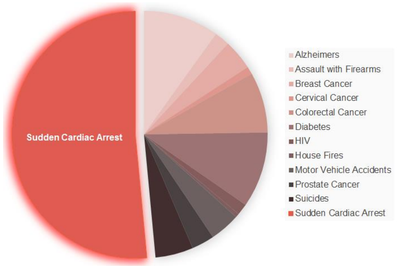
MULT603 | **Team members:** Jon Dyke, Majid Alashari, Ashraf Al Gumaei | **Faculty Advisor:** Erdem Topsakal, Ph.D.
Clinical Advisor: Joseph Ornato, M.D., FACP, FACC, FACEP

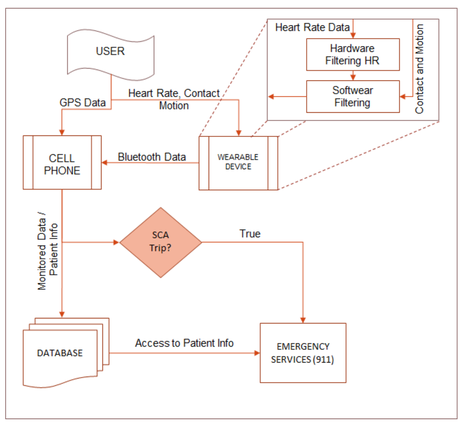
CAPSTONE DESIGN EXPO 2017

Introduction

♥ The Problem

- According to the American Heart Association, cardiac arrest is the most prominent cause of death globally. [1]
- 326,000 people per year experience sudden out of hospital cardiac arrest (SOHCA) in the U.S. [1]
- Every minute that follows from the onset of cardiac arrest, the risk of death increases by 10%; brain damage becomes inevitable after nine minutes. [1]





♥ The Goal

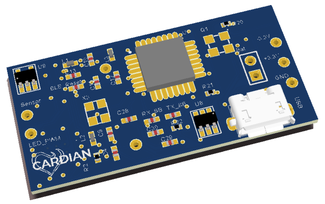
- Construct a wearable device that can detect Cardiac Arrest and notify emergency personnel, friends, and family members.
- Design and Build the wearable device components to include heart rate detection, Bluetooth connectivity, and skin contact sensors.

Hardware Design

♥ Photo Plethysmography (PPG) Heart Rate Detection

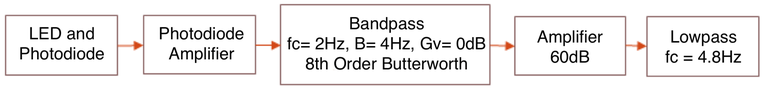
Hardware Features:

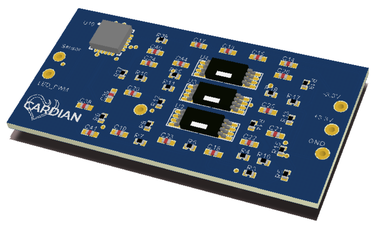
- Two PPG Sensors (Dorsal & Palmar positioning)
  - Two photodiode/LED sets connected to a band pass filter of the 8th order
  - Photodiode amplifiers
- Inertial Measurement Unit (MPU6050)
- Bluetooth Communication (NRF8001)
- Atmel Microcontroller (ATMEGA328P)
- Rechargeable 200mAh LIP Battery
- Skin Contact Sensors



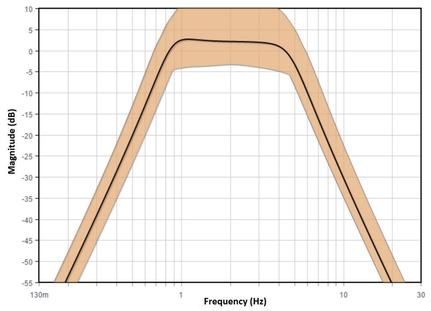
Top-side of top board, 20mm x 40mm

♥ PPG: Wavelength 528nm light incident on skin and reflected to photodiode sensitive to 540nm changes reflectance to due change in capillary volume. Generates 0.8Hz to 3Hz pulse signal. Signal amplified after passing though bandpass filter



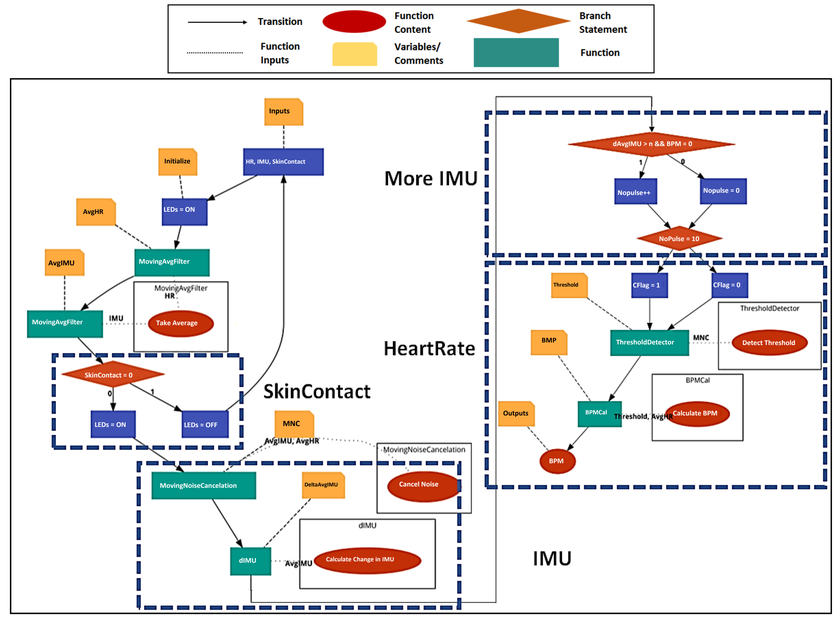


Bottom-side of bottom board, 20mm x 40mm

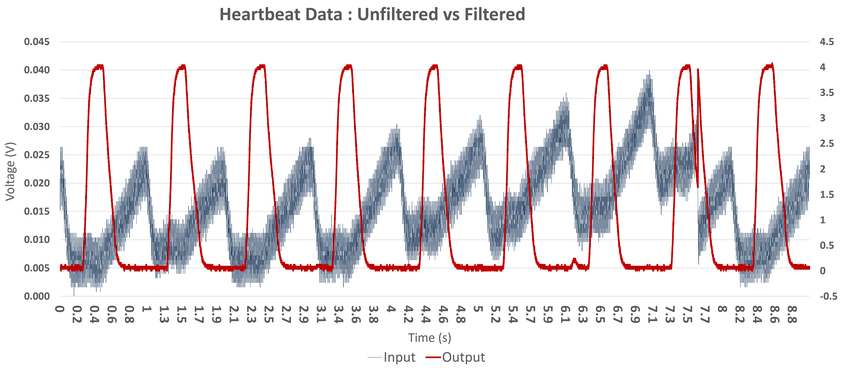


Bandpass Filter Response

Software Design



Software Algorithm Implementation



References

1. American Heart Association.Heart Stroke Statistics.American Heart Association.http://www.heart.org/HEARTORG/General/Heart-and-Stroke-Association-Statistics_UCM_319064_SubHomePage.jsp. 2016.