



CALIFORNIA STATE SCIENCE FAIR 2017 PROJECT SUMMARY

Name(s) Lauren Hinkley; Sarah Kazmie	Project Number S0812
Project Title CardioWatch	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals To create a system to track, monitor, recognize, and diagnose Heart Rate Variability (HRV) in real-time, which can be integrated with or improve upon the current iWatch and Fitbit systems that are limited to tracking and monitoring heart rate. This system would create a way to not only track and monitor pulse, but to measure and monitor heart rate variability (HRV) which can be used to diagnose heart disease, and may be an early indicator of heart attack.</p> <p>Methods/Materials Configured and programmed a Cypress PSoC 4 with an embedded analog digital converter (ADC) to monitor and digitize the analogue output from a LED/Sensor pair. Configured and programmed embedded UART to transmit data and receive simple commands from a PC USB interface. Using a terminal program (ZOC 7), tested and logged more than 50 sessions of live pulse signal readings. Implemented automatic data calibration, scaling and normalization. Implemented original real-time R Wave peak detection algorithm, combing LPF, differentiation and back-buffer ray-casting. Implemented event offset/beat detection algorithm. Used data recorded from early pulse signal recordings to pulse width modulate (dim) an LED to create a consistent test pulse. Using a random number generator, alternately injected delay states into the generated pulse signal to simulate heart rate variability in a controlled and measurable manner.</p> <p>Results We we able to successfully track heart rate variability using a simulated heart rate with varying degrees of variability.</p> <p>Conclusions/Discussion While there is still much work ahead, results indicate that our CardioWatch device can successfully analyze and detect Heart Rate Variability in real-time, using an LED, a sensor, 2 resistors and an inexpensive (< \$2.00) microcontroller. Our CardioWatch technology could be easily and affordably integrated into consumer devices such as Apple Watches and Fitbits, allowing these devices to provide timely feedback to wearers and their medical providers.</p>	
Summary Statement Using a PSoC 4 chip and external heart rate sensor, we wrote a C program to track and monitor heart rate variability as an indicator of Cardiovascular Disease.	
Help Received Throughout the course of our project, we had a mentor answer questions pertaining to programming and the type of chip that was best to use.	