



CALIFORNIA STATE SCIENCE FAIR 2016 PROJECT SUMMARY

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Project Title The Use of Photoplethysmography (PPG) to Develop a Prototype Heart Rate Wristband to Monitor Life Threatening Arrhythmia	
Abstract Objectives/Goals The objective of our project is to save the lives of the nearly 300,000 people that die of cardiac arrest in the United States alone, every year. These peoples deaths are preventable, as they only die because they do not make it to the hospital in time. Thus, to save these people, we created the proof of concept of a wristband that will continually monitor heart rate and alert EMS from the phones of those in danger of imminent cardiac arrest. Methods/Materials We used an Arduino microcontroller, which is a prototyping shield, and its associated coding platform. Using these, we were able to connect a PPG (photoplethysmography) sensor, and use this advanced technology to monitor heart rate. The coding that we implemented within the platform was both source code and modifications to this code to make the heart rate algorithm, and and achieve our goal. We tested it ourselves for bradycardia, tachycardia, and sinus rhythm (heart arrhythmias), which it successfully recognized. The phone application was developed using Blynk software (and IOS and Android application) which is customizable as per the creator's preference. Results The PPG sensor system prototype read various arrhythmias with maximum accuracy, producing results and notifications as soon as the given arrhythmia was detected. Notifications regarding EMS were received via the phone application. Given the different parameters between 40 beats per minute (BPM) and 200 BPM, the notification was triggered 100% of the time, with 100% accuracy. Conclusions/Discussion We created a proof of concept prototype PPG sensor system using the Arduino platforms and hardware that allows for the detection of sinus rhythm and the other arrhythmias that we were examining and analyzing: ventricular and supra-ventricular tachycardia, ventricular fibrillation, and severe bradycardia. Since the system that we designed notifies the user on their smartphone via the Blynk application as soon as one of the above arrhythmias are detected, it is probable that people who have life threatening arrhythmias (that lead to cardiac arrest) will be able to receive treatment from a hospital on time.	
Summary Statement We developed a prototype heart rate wristband that has the application to notify EMS and potentially save those with life threatening cardiac arrhythmias.	
Help Received We designed the system ourselves after research of the needed algorithms and had some help from our teacher, Dr. Gettman, in working out issues in the coding.	