SmartRate: An Innovation in Automated Early Warning, Detection, and Prevention of Cardiac Death

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The foremost illness in America is heart disease, and current methods of prevention are not enough to mitigate the high fatality rate. Affecting millions worldwide, this disease leads to cardiac arrhythmias and corresponding conditions such as ventricular fibrillation, ventricular tachycardia, atrial fibrillation, and severe bradycardia. All of these abnormalities can lead to cardiac death. To combat this, this project aimed to diagnose, predict, and prevent arrhythmias through a novel notification and prevention algorithm. Using an Atmel microcontroller, a photoplethysmographic heart rate sensor, and an iOS application connected via Bluetooth to the user's smartphone, the wristband monitored arrhythmias with ease and low cost production, regardless of previous knowledge of underlying conditions. With the built-in software recognition of false-positives through extensive signal analysis within MATLAB, coded within Arduino, the heart rate detection algorithm performed with correlation to electrocardiographic machines prevalent in hospitals. Upon confirmation of a cardiac arrhythmia, the user is immediately notified, and if no response is registered due to unconsciousness, the iOS application will call Emergency Medical Services. The application also has a data log for further diagnoses, allowing for further doctoral and medical analysis. Testing was performed on multiple subjects of various ages and genders, and data showed that without a false positive, 100% of the time, the notification warning system was triggered. The wristband apparatus has created the possibility of reducing excess funding within hospitals, diminishing diagnosis time for arrhythmias from days to seconds, and thereby dramatically decreasing Emergency Medical Service time from hospital to victim.

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