Rebeat: A Real-Time, Audiovisual Feedback System for Improving CPR Quality

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Cardiovascular disease is the leading cause of death worldwide, and about half of the 17 million annual deaths are due to sudden cardiac arrest. While prompt administration of high quality cardiopulmonary resuscitation (CPR) is the main deciding factor of a victim's survival, adequate help is rarely available, resulting in an overall survival rate of ~10 percent for out-of-hospital cardiac arrests. We have developed an easy-to-use, audiovisual feedback system, thereby creating an effective solution for improving bystander and first-responder CPR quality. The project consists of two main components: the custom printed circuit board and hardware, and the recurrent neural network model for computing CPR metrics. We designed the system to adhere to current CPR standards of 5~6 cm of compression depth, 100~120/min rate, and complete recoil between compressions. We were able to achieve a mean absolute error of 0.157 cm for the depth calculation model. To evaluate the effectiveness of our system, we performed 10 tests, each consisting of 30 seconds of manual CPR on a manikin with detailed analytics, averaging the best five results for the analysis. We were able to achieve excellent results of 56.00 mm compression depth, 110.2/min rate of chest compressions, and 100.0% complete recoil. In contrast to methods such as dispatcher assistance, we were able to demonstrate sustained accuracy in both compression depth and rate. The system's total cost came under $150, which was significantly cheaper compared to inferior, existing feedback devices (~$850), and automatic chest compression systems (~$21k). The project's most significant contribution is the system's ability to enhance laymen performance of CPR on compression depth, rate, and recoil in a compact form factor.

Awards Won:
Second Award of $2,000