

Stress is a reaction that can negatively affect many people, and it has a strong correlation to Heart Rate Variability (HRV). HRV is a measure of the variation in time between each heartbeat and is used to identify overall well-being and irregularities for one's stress and anxiety levels. Research shows that vibrational pulses can reduce stress and increase HRV. Similar solutions utilizing haptic technology to reduce stress already exist, but are not cost-efficient, ranging from \$350+. The same hardware implemented in such solutions is also found in many popular and accessible smartwatches, such as the Apple Watch, meaning the solution can be implemented through an innovative application.

The objective of the application will be to autonomously use vibrational pulses, heart rate, and resting heart rate to reduce participants' stress/anxiety levels and increase participants' HRV levels. Having less stress and a higher HRV will increase the participants' well-being.

A WatchOS application will be developed using the Xcode software and Swift UI. The application will send light haptic pulses to the user at a frequency based on their current heart rate and their resting heart rate. The pulses will continue until the user's current heart rate matches the user's resting heart rate. The Cor-Sense HRV monitor will also be used to collect participants' HRV data. The cloud database, Google Firebase, will be used to store participants' HR and HRV data. An iOS companion app will be also developed to graphically display the user's HR and HRV trends, which will be implemented using the stored data from firebase. To test the application, 30 or more high school participants will be gathered. Participants will be split evenly into two groups, Group 1 and Group 2. Both groups will complete 100 Algebra 1 based math questions in a 10 minute time period. Before the task, both groups will also complete 5 practice problems for a control which will not be timed. During the task, Group 1 will not receive the vibrational pulses while Group 2 will. Before and after the task, both groups will also complete a State-Trait Anxiety Inventory (STAI) test, which measures state anxiety, such as temporary nervousness or discomfort, and trait anxiety, such as day-to-day feelings of stress or worry. The STAI test is based on a 20-80 point scale, with lower scores reporting lower stress and anxiety levels. During the task, participants' HR and HRV will be monitored for both groups. Data will be analyzed to identify which group has the higher HRV and task performance while having the lower HR and STAI test results.

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