# Battery System Optimization and Development of a Novel Rapid-Response Bioelectronics Device

Lall, Rahul

Reducing paramedic response times to five minutes could nearly double survival rates of patients experiencing life-threatening medical conditions. Maintenance of an independent lifestyle with a comparable level of monitoring requires the development of devices which can provide continuous monitoring and timely medical intervention when needed, without the tie-down constraints of a hospital setting. In this project, a novel rapid-response flexible wearable bioelectronics device has been developed to allow for measurement of vital signals of a patient outside of a hospital setting. A prototype of the device has been fabricated and an android platform based application developed for the implementation of the system. This device monitors sudden changes in biometric information, such as pulse and muscle activity in users and connects to an android phone via a Bluetooth module to call 911 if necessary. This device is intended to decrease paramedic response time during emergencies as well as decrease the percentage of victims of sudden causes of death. Wearable electronics need flexible power sources for running them, in addition to being able to survive the stresses of daily motion during operation. The system and the flexible power sources have been subjected to the stresses of daily motion in a motion-control setup to assess the survivability of the design. Additionally, a method for prognosticating the capacity degradation and remaining useful life of these flexible batteries has been developed using Extended Kalman Filtering (EKF) and Levenberg-Marquardt (LM) Algorithm.

**Awards Won:**

International Council on Systems Engineering - INCOSE: Certificate of Honorable Mention