Chest Band Energy Harvesters

Overview
The purpose of our project is to design a chest band that can harness the kinetic energy created from the expansion of the chest and convert that to electrical energy to power small wearable devices such as a heart rate monitor. This project is being developed to prove the possibility of harvesting energy from the human body in this manner.

Objectives
The two most important objectives of this project are: to increase the output power of the chest band, and minimize user discomfort when wearing the device.

Approach
• Due to the unique nature of our project, the primary customer for this product is a research team, the Penn State Mechatronics Lab.
• Based on the Sponsor’s needs, an extended research on existent patents and available materials was conducted.
• The project was divided into two main subsystems, electrical and mechanical.
• For the electrical subsystem, RC analysis was conducted to find the components for an energy harvester circuit.
• For the mechanical sub-system, the team analyzed and tested different return mechanisms motor driving techniques.
• The team created SolidWork models to fit each of the subsystems
• The team built two different prototypes and tested them with the electrical subsystem.
• Both mechanical subsystems were tested under different load resistance with steady deep breathing.

Outcomes
With an optimized electrical sub-system, the chest band energy harvester could provide 90 mW of peak power and 25 mW average power under 100 Ω load. This increases by a factor of 10 compared to the power output of the past team’s chest band energy harvester prototype. These results showed that:
• It is possible to generate small amounts of power form chest expansion to power wearable electronic devices.
• The Velcro belt does not lead to user discomfort, while providing easy mounting for components.