Pressure sensing orthotic brace for pectus carinatum

Overview
The problem that our sponsor has presented to our team was to build a medical device for patients with pectus carinatum symptoms. Our team created a device that attaches to an orthotic brace that periodically measures and maps the pressure of patient's chest. The goal of this device is to help both patient and physician to closely monitor and shorten their treatment process.

Objectives
Dr. Anthony Tsai of the Penn State College of Medicine requested a brace design that would accurately measure how much pressure is applied at specific points on the chest of patients with pectus carinatum. This brace would give more valuable information to both the doctor and the patient.

Approach
- Our team gathered customer needs by speaking with our sponsor, Dr. Tsai, as well as one of the patients who wears the orthotic brace
- After speaking with them, our team created concept generation and selection
- Our team read a few conference papers that describe similar concept and idea of our project
- Couple of our team members have visited our sponsor and a patient in Hershey Medical Center to gather data
- We used Arduino software, MATLAB, and SolidWorks to evaluate our design and alternatives
- We created a CAD drawing of the entire system to better visualize our design
- Our team fabricated three prototypes using Arduino, electric components, and pressure sensor to make it more compact each time
- Our team performed multiple testing on our pressure sensor to make sure the data were correct
- Our team calibrated the data and validated it by observing whether or not the calibration curve matches our and our sponsor’s expectation
- Our team generated a 10 by 16 array of pressure data in the Arduino and analyzed by looking at a pressure map that is generated by MATLAB

Outcomes
- The final prototype will allow patients to wear the brace while simultaneously taking pressure readings.
- The doctors can use this data to maximize treatment for pectus carinatum by making sure the pressure being applied is optimal
- The project will also help doctors monitor patient compliance by seeing when the patient is actually wearing the brace.
- Despite costing a relatively small amount, our project is the most accurate pressure sensing brace out there since it takes pressure readings across the whole entire treatment area.