Utilizing Cardiac and Pulmonary Function with Piezoelectricity to Power a Cardiac Pacemaker

Somawardana, Isuru

The purpose of this experiment is to find a way to provide a constant supply of electrical power to a cardiac pacemaker utilizing cardiac and pulmonary motions in conjunction with piezoelectric generators. Cardiac pacemakers are powered by a lithium battery with a finite lifetime. Even though there have been substantial improvements in storage increases and reductions in overall size, lithium batteries still remain vastly ineffectual. More than 60% of the batteries implanted run out of charge within 1 to 5 years, and the other 40% running out of charge within 5-7 years. The only way to replenish the battery is to surgically remove it and put in place a fresh battery. These surgical procedures to replace the depleted batteries of implantable devices are thus essential, even though it exposes patients to additional health risks, heightened morbidity, and even potential mortality. A model (unsuccessful) and simulation (successful) of both lungs and heart were created. Five trials were conducted for both cardiac and pulmonary simulations, and averages and standard deviations were calculated. According to the average data, the heart and lungs produce 141.63 mW of power together ever second with is enough by far to power a cardiac pacemaker. Using online data gathered of height, heart rate, and breath rate of children aged 0-18, the power generation of cardiac and pulmonary motions of subsequent ages was also estimated. In conclusion, the natural contractile motions of the heart and lungs are more than enough to power any standard cardiac pacemaker.

Awards Won:

Fourth Award of $500