Harvesting Energy at Your Fingertips: Harnessing Mechanical Energy from Typing for Sustainable Power Generation

Giuseppi , Sienna (School: Pelham Memorial High School)

Electricity production is one of the greatest contributors to CO2 emissions, with its utilizations ranging from the heating of households to the charging of electronic devices. Piezoelectricity is the phenomenon in which electrical charge is accumulated in response to applied mechanical stress. While piezoelectric technology is widely recognized for its energy conversion capabilities, its integration in small-scale energy harvesting remains relatively unexplored. An application within computer keys is investigated in this study. A prototype for a singular computer key optimized for piezoelectric energy harvesting was designed, constructed, and tested. The average force exerted on a computer key was determined to be 1.6N through testing with a force probe. Potential differences of hard and soft piezoelectric plates in response to said force were compared, but found to have no significant difference in ability to produce voltage. A computer key was constructed incorporating one of the PZT plates, and was tested over a period of 10 seconds, yielding a peak of 0.403V per keystroke when subjected to 1.6N of force. This study provides evidence that this piezoelectric key design can effectively generate electricity through typing, and is the first to successfully integrate piezoelectric energy harvesting material into an everyday appliance. This design offers a clean and more sustainable power source for laptops, thus contributing to reducing our carbon footprint and dependence on non-renewable energy sources through renewable small-scale energy generation technology.

Awards Won:
Air Force Research Laboratory on behalf of the United States Air Force: Glass trophy and USAF medal for each recipient
Air Force Research Laboratory on behalf of the United States Air Force: First Award of $750 in each Regeneron ISEF Category,