CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Shaya Zarkesh

Project Number
J0934

Project Title
A Novel Approach to Generating Electricity through Walking Shoes

Abstract

Objectives/Goals
Portable and wearable devices are becoming more and more of a part of human lifestyle. Unfortunately, these devices are limited by their battery life. As non-renewable energy sources begin to diminish and as we go further into the digital age, finding new sources of energy will only become more significant. A shoe that could transform downward pressure exerted while walking into electricity would be groundbreaking if it was comfortable and efficient enough to charge mobile devices.

Methods/Materials
After some research, two forms of electricity generation, piezoelectric and a generator, proved to be the most feasible to accomplish this feat. Although piezoelectric would be easier to implement since it takes up less space, I chose to use a physical generator because of its much higher efficiency. Existing solutions that used piezoelectric only generated 1-2 mW, which is thousands of times too small to charge a smartphone with a battery of 6 Watt-hrs. After testing a hydrogenerator and realizing how insignificant its electricity output was, I tried using a mechanical generator. By removing the large parts of a salad spinner, I was able to attach its core to the shoe box, and its lower section would spin when the button was pressed downward. Two bevel gears then changed the axis of rotation from vertical to horizontal for the generator shaft to spin.

Results
At first, I used a gear ratio of 1:1, but when I tested the generator's output with a multimeter, the power generated only averaged 280 milli-Watts. Though far better than piezoelectric solutions, it still proved somewhat impractical for charging phone batteries. To improve my design, I increased the gear ratio to 37:13, which increased the average output to 740 mW. When coupled with a transformer and regulator, this shoe could theoretically charge the iPhone 5s in 8 hours.

Conclusions/Discussion
My implementation of electricity generation in a shoe generates over twice as much electricity as current solutions have shown. However, the shoe is currently too large and uncomfortable appeal to consumers, and lowering the sole height would be crucial. Before the competition, I aim to reduce the height of the sole, insert padding for comfort, and implement a means of transferring the harvested electricity into a smartphone. If time permits, I would also like to increase the electricity output further by implementing a gear train inside the shoe.

Summary Statement
My project aims to design and produce a shoe that would generate electricity, allowing its user to charge a mobile device.

Help Received
Grandfather helped with sawing and gluing parts of shoe together, Mrs. Morgensen helped with abstract and general guidance; Father helped with buying materials and general knowledge about circuits.