



Kinetic Energy Harvesting Device

Spencer Coffin (Engineering Undecided), Amy Loomis (Mechanical Engineering),
 Alec Sirocki (Environmental Engineering), Peter Wallace (Management Engineering)
 Peer Learning Advisor: Matt Connolly (Fire Protection Engineering/Mechanical Engineering)
 Faculty Advisor: Professor Fred Looft (Electrical and Computer Engineering)

Background

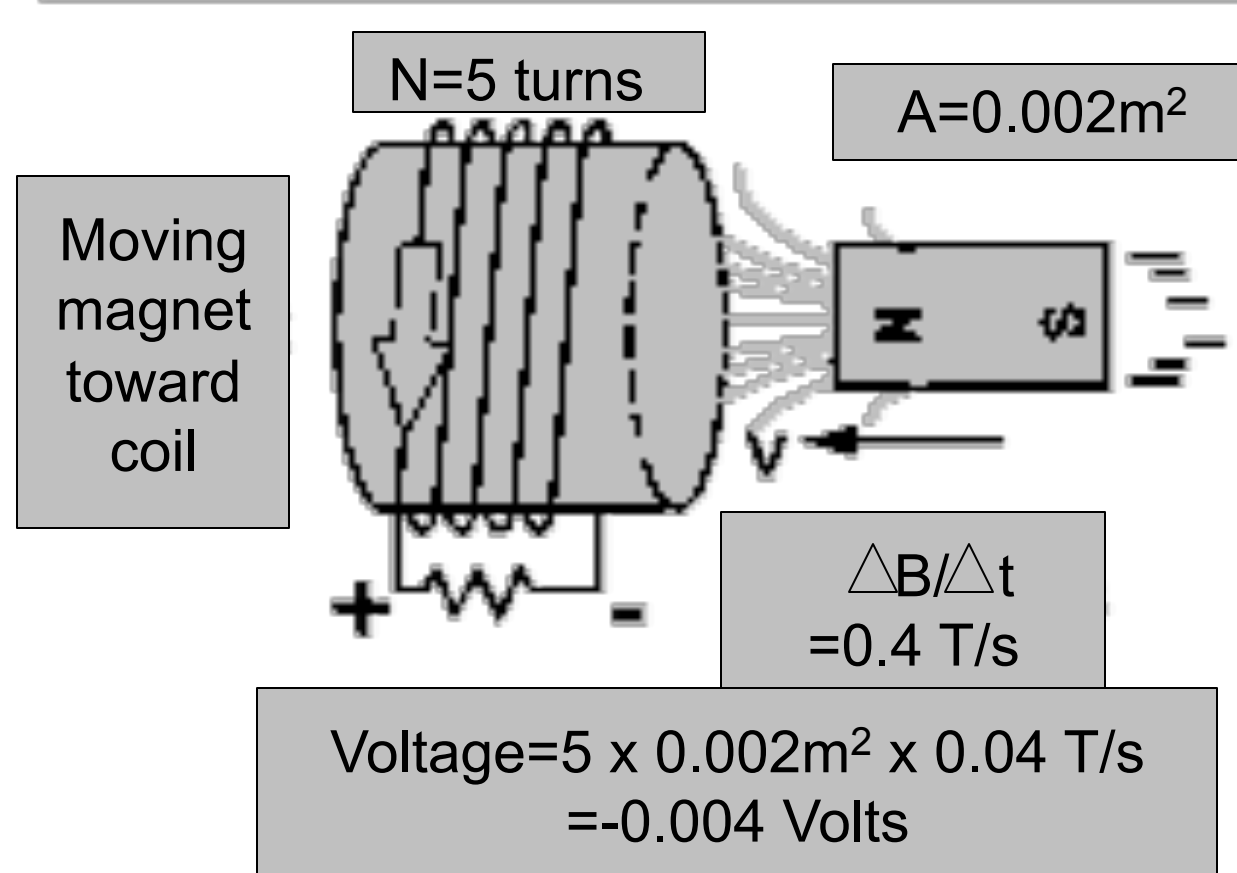
No process involving a transfer of energy is 100% efficient, nor can ever be. During our research, we focused on the concept of capturing wasted energy and transforming it into electricity to reuse; essentially recycling energy.

We first limited our search for sources of energy to bodily heat, solar cells, and kinetic energy from the motion of walking. From there, we decided capturing and transforming kinetic energy was the most feasible source to work with based on prior knowledge, potential to design a functioning device, and the possibility of taking the device concept further after this project is complete.

Subsequently, we designed prototypes as seen to the right; each of which is fundamentally based on the principle of electromagnetic induction as stated in Faraday's Law:

$$\text{Voltage generated} = -N \frac{\Delta(BA)}{\Delta t}$$

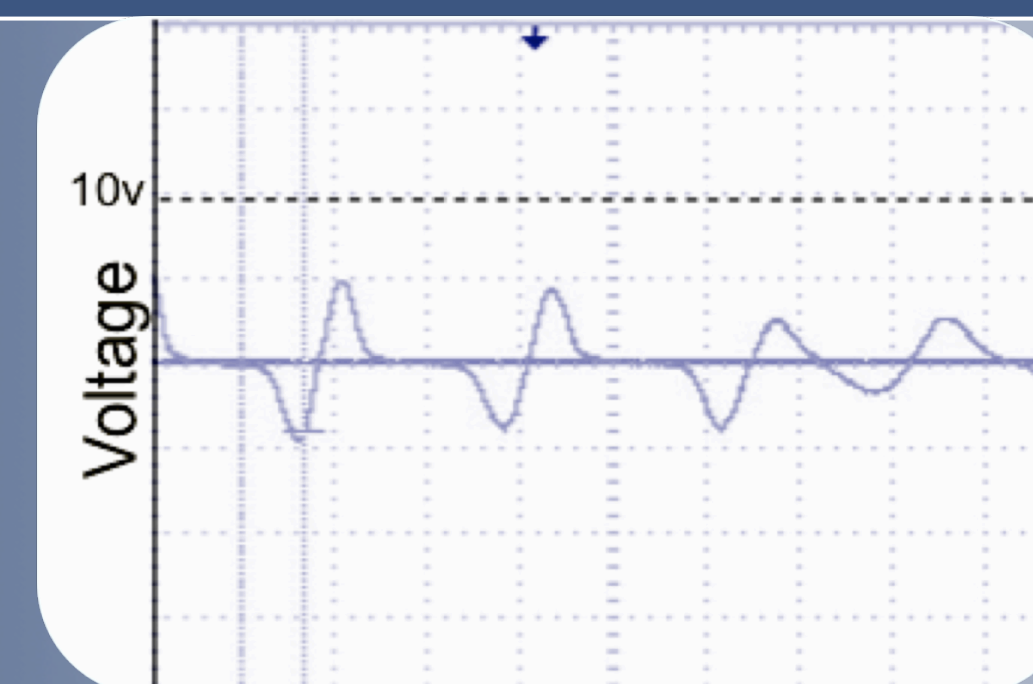
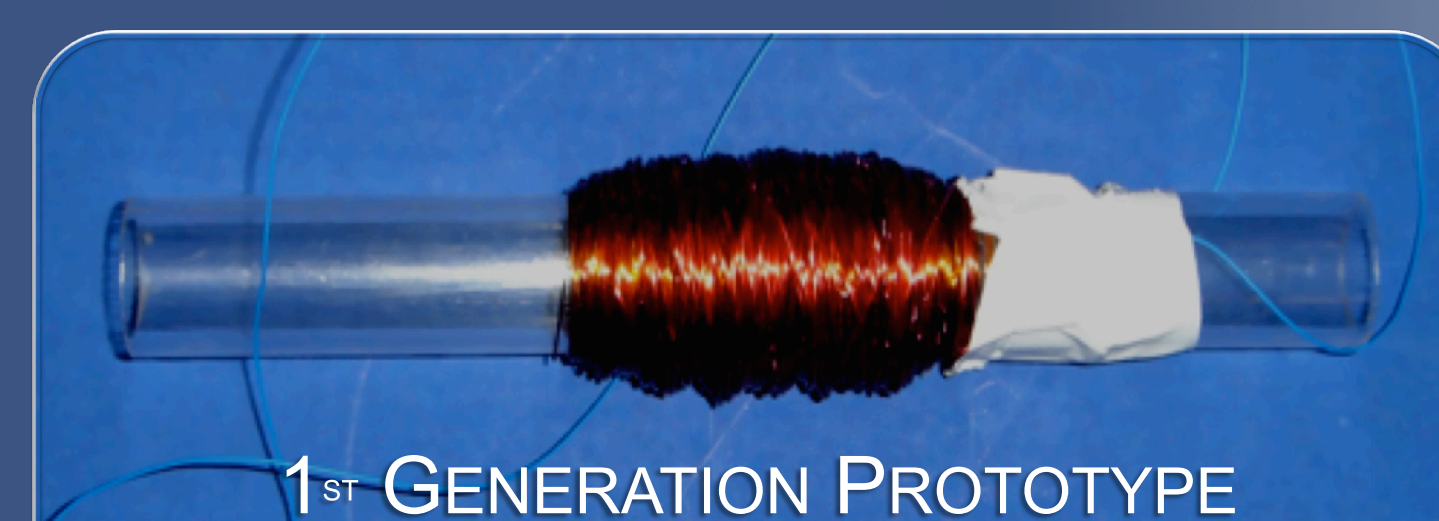
Faraday's Law



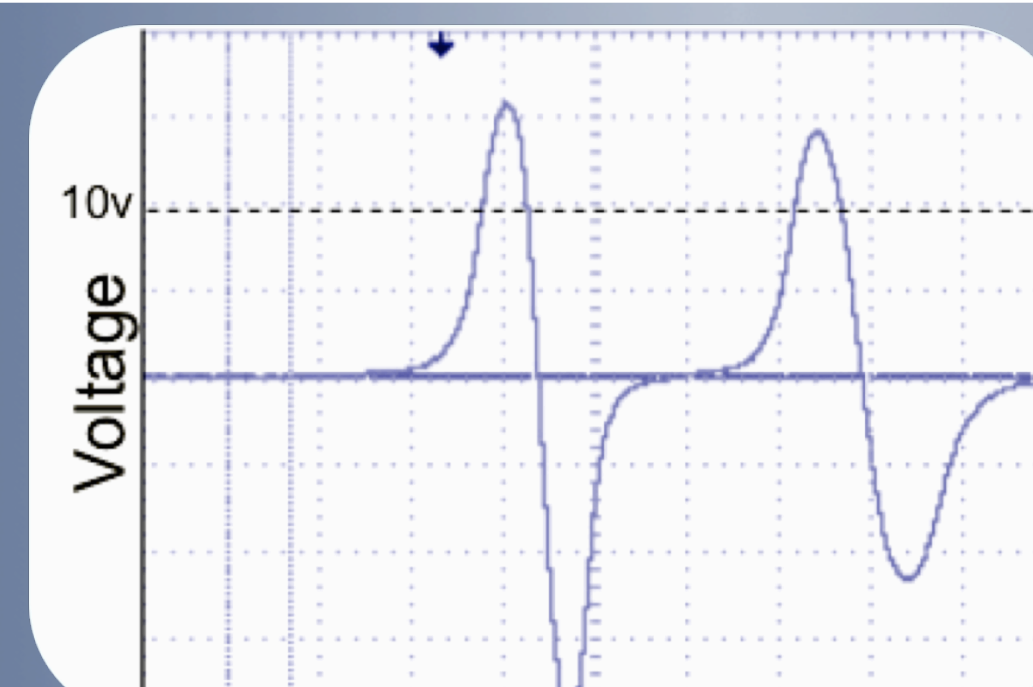
<http://hyperphysics.phy-astr.gsu.edu/HBASE/electric/farlaw.html>

Abstract

The purpose of this project was to design and build a socially and technologically sustainable energy-harvesting device that captures and transforms wasted kinetic energy into electrical energy for storage and later use. Using electromagnetic induction to capitalize on Faraday's Law, our ideal system involves a coil of wire, a suspended, oscillating magnet, a diode bridge rectifier, and a rechargeable battery that would produce enough power to charge a pocket-sized electronic device. As an alternative source of energy, targeted towards individual users, this kinetic energy harvesting device provides a sustainable source of electricity without ever using energy from the power grid.

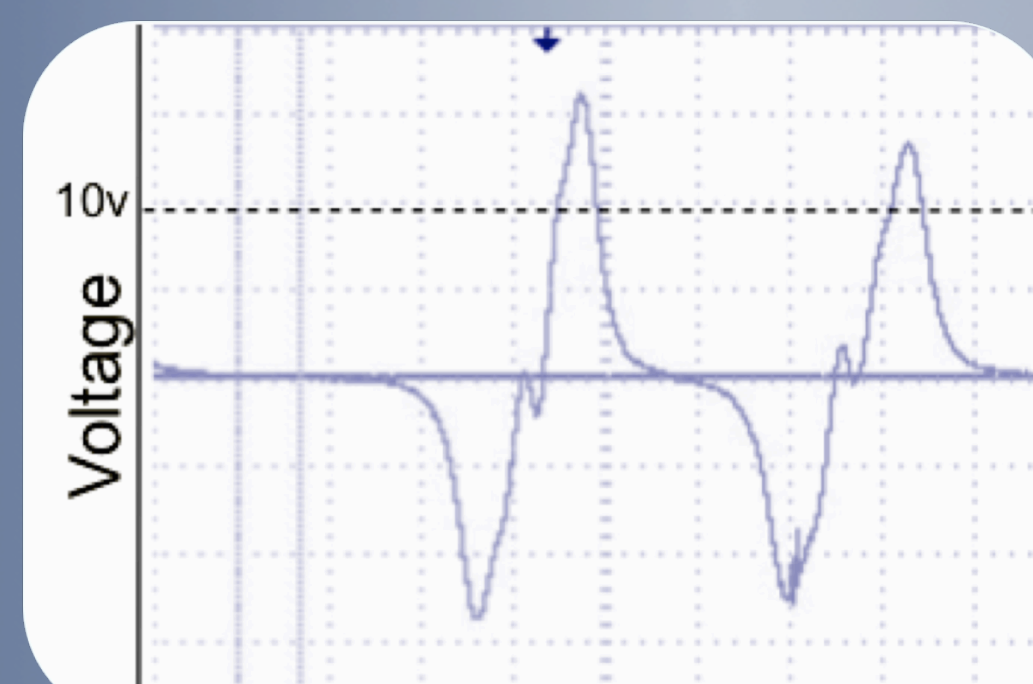


- Test if the design is functional
- Used springs inside each end to supplement the oscillation of the magnet

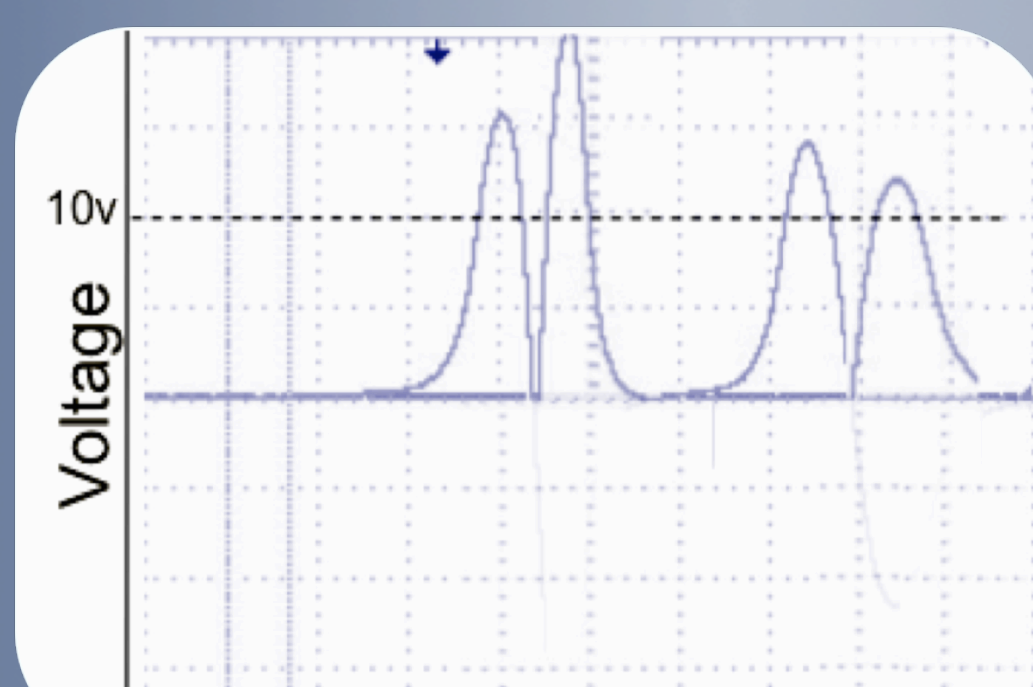
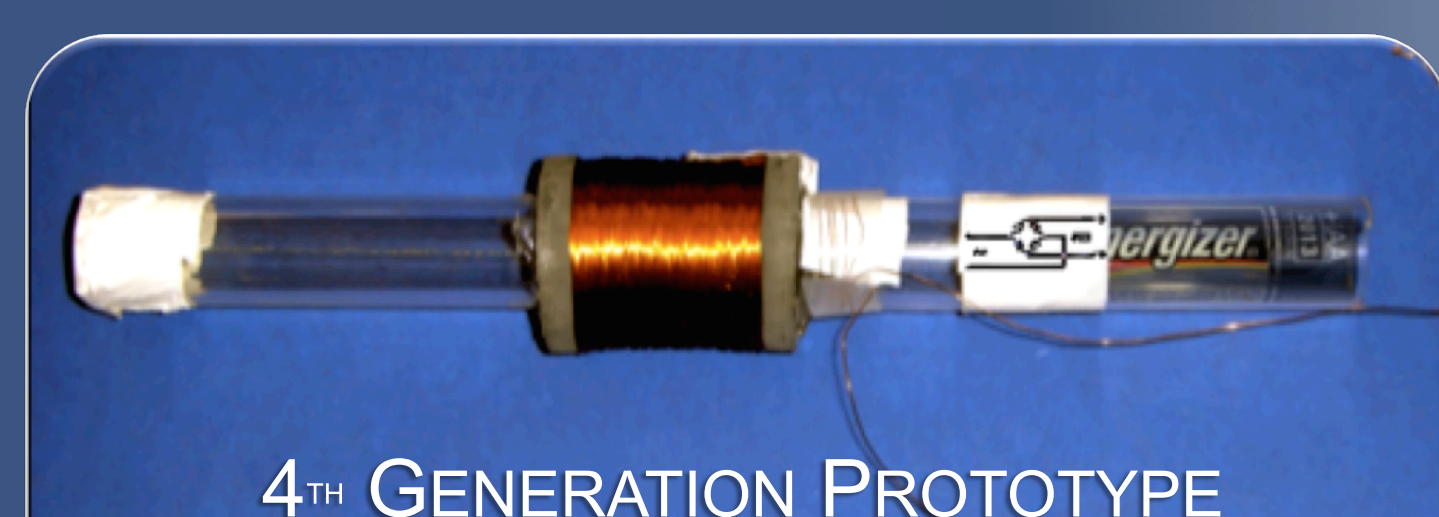


- Plastic spacers cause a large change in magnetic flux over a short amount of time as the magnet passes through the coil

Stationary magnets on either end inside the tube suspend the oscillating magnet and magnify its motion



- Broke the large coil into 3 smaller coils; provide multiple changes in flux during one pass of magnet



- Ideal design for a fully-functioning prototype; use large, single coil, stationary cap magnets included

Diode bridge rectifier converts AC to DC to charge the internal rechargeable battery

Conclusion

- The final device is functional
- Our final design incorporates our second-generation prototype, a diode bridge rectifier, rechargeable battery, and USB port to charge pocket sized portable devices
- The design can be used by active individuals, and also by those who depend on their electronic devices and cannot afford for them to run out of battery
- Mass production is feasible with further modification

Moving Forward

- Build the complete fourth-generation design and test its capabilities of producing electricity and actually charging a device by capturing kinetic energy
- Test how much electricity could actually be made during different activities to determine true effectiveness

Future Work

- Work with Mr. Mike Manning to investigate the potential for protecting intellectual property associated with this device, possibly including patents for components of the design
- Work with Professor Looft during C term to develop a functioning prototype including all necessary components that will directly charge mobile devices via USB cable