CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
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Project Number
J0911

Project Title
Wireless Power Transfer: The Effects of Changing the Coil's Diameter on the Power Transmitted

Abstract

Objectives/Goals
The goal of my experiment was to see if it is possible to transfer power wirelessly, and to see if changing the diameters of the transmitter and receiver coils will affect the power transferred. Another goal was to study the impact on the power transferred when using fixed length/variable turns and variable lengths/fixed turns of wire to build the primary and secondary coils. The experiment was extended to study the effects of varying the number of turns of the coils, the gauge of the coils, and relative positions of the primary and secondary coils on the power transferred.

Methods/Materials
Breadboard; Battery; Resistor; Capacitor; Transistor; Wire; Multimeter.

Results
The readings were best for the coil with 30 cm diameter (the largest coil) and lowest for coils with 5 cm diameters. The readings were generally higher for coils with diameter 15 cm and up. For the same diameter, the fixed length coils with variable turns gave higher readings than the variable length coils with fixed turns. From my extensions, the readings were higher with coils of 24 AWG wire than 20 AWG wire. The readings were also generally higher for higher diameter coils with larger number of turns. The readings were also better when the relative positions of the primary coil and secondary coils were such that there was a large overlap in the magnetic fields of the coils.

Conclusions/Discussion
Wireless power transfer is possible because of electromagnetic induction and magnetic resonance. In wireless power transfer, efficiency of transfer is improved when the magnetic resonance between the coils is improved. This can be achieved by making the inductive and capacitive reactances of the coils the same and by ensuring that the magnetic flux fields of the transmitter and receiver coils overlap as much as possible. In my experiment, increasing the diameters of the primary and secondary coils improved the power transferred as there was more overlap in the magnetic fields thus improving resonant coupling. For the same diameter, if the numbers of the turns of the coil was higher we generally got better outcome voltage as it improved the inductive reactance of the coil which in turn increased magnetic flux. When the coils were in placed further away from each other, resonant coupling was low so the voltage transmitted was low. If the coil diameter is lower than the distance between the coils, power transferred falls for the same reasons.

Summary Statement
My project is about wireless power transfer and the effects of changing the coil's diameter on the power transferred.

Help Received
My parents helped me make my setup and create my display board.