



CALIFORNIA STATE SCIENCE FAIR 2016 PROJECT SUMMARY

Name(s) Dhruv N. Aggarwal	Project Number J0901
Project Title Wi-Tricity: Wireless Electricity Using Resonant Inductive Coupling	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals To learn more about wireless power transfer, its current limitations, and begin to recognize future applications of this technology.</p> <p>Methods/Materials My research pointed me to resonant inductive coupling, and I selected to work on a Bifilar Coil implementation and a Slayer Exciter Circuit. Bifilar Coil: My design uses a bifilar coil setup in a circuit to switch at 30Hz converting a DC voltage into an AC that coupled inductively with two receiving coils transferring power. Slayer Exciter Circuit: My preliminary design used a secondary coil with nearly 350 turns and I initially did not realize the criticality of the geometrical aspect ratio between the tube diameter and the winding length. I researched coil inductances further, and built prototype 2 which worked, however only after adding physical capacitors to the earth capacitance. To debug the issues, I simulated the circuit in LT Spice, and learned its intricate workings, which helped me build prototype 3 and confirm measurements using an oscilloscope. Next, I investigated the effect of resonance frequency and secondary voltage on the power transfer distance. I used prototypes 3, 4 and 5 which had different secondary inductances, therefore resonating at different frequencies, and collected the power transfer distance data while changing the turns, ratio. I took multiple measurements using a fluorescent bulb held horizontally, vertically, and on top of the toroid.</p> <p>Results The Bifilar Coil transferred power up to a distance of 6 inches to another coil, and even powered a DC motor. The Slayer Exciter circuit ionized the inert gases inside a fluorescent bulb making it glow. When the circuit was resonating at the lowest frequency the power transfer distance was the maximum around 12 inches. The secondary voltage also increased the distance.</p> <p>Conclusions/Discussion One of my key learnings on the Slayer Exciter circuit was the criticality of the build of the secondary coil to achieve a particular oscillation frequency. Fortunately, this circuit does not require tuning between the primary and secondary due to the feedback loop from the secondary directly to the base of the transistor. As my next build, I want to increase the power output using a better driving circuit instead of my single transistor.</p>	
Summary Statement This project studies methods to transfer power wirelessly including specific implementations of the Bifilar Coil and the Slayer Exciter circuit.	
Help Received My father helped with soldering the electrical connections.	