E2.03 - Power Shake - Wind Vortex Team

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TEXAS STATE® INGRAM SCHOOL OF ENGINEERING

Team

Meet the team!

Ryan Fassnidge|Kayla Adderley(P.M.)|Aaron Holley|Skylar Roath

Team Member Subsystems

Kayla Adderley(Project Manager) - Distribution

Skylar Roath - Accumulation

Aaron (AJ) Holley - Rectification & Conditioning

Ryan Fassnidge - Generation

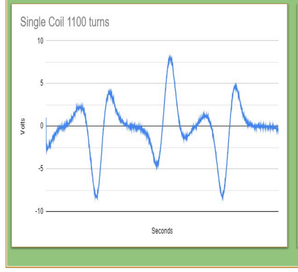
Goals & Requirements

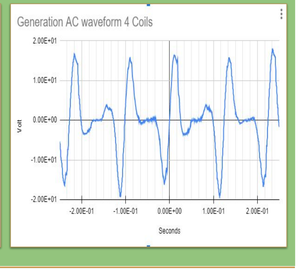
- Our team will demonstrate induction generation through the manual rocking of our structure with the coils attached to an oscilloscope.
- Our goal for D2 was to have a structure that has a platform which utilizes 2 coils to generate power in order to charge a battery. The battery will then supply power to a usbA port and battery display.

Coil Design	Prototype 1 22 AWG	Prototype 2 28 AWG
Winds	270	1100
EMF 1-3Hz	0.61V-1.82V	2.27V-8.12V

Coil #1:
270 turns easier to turn less effective struggled turning on diodes.

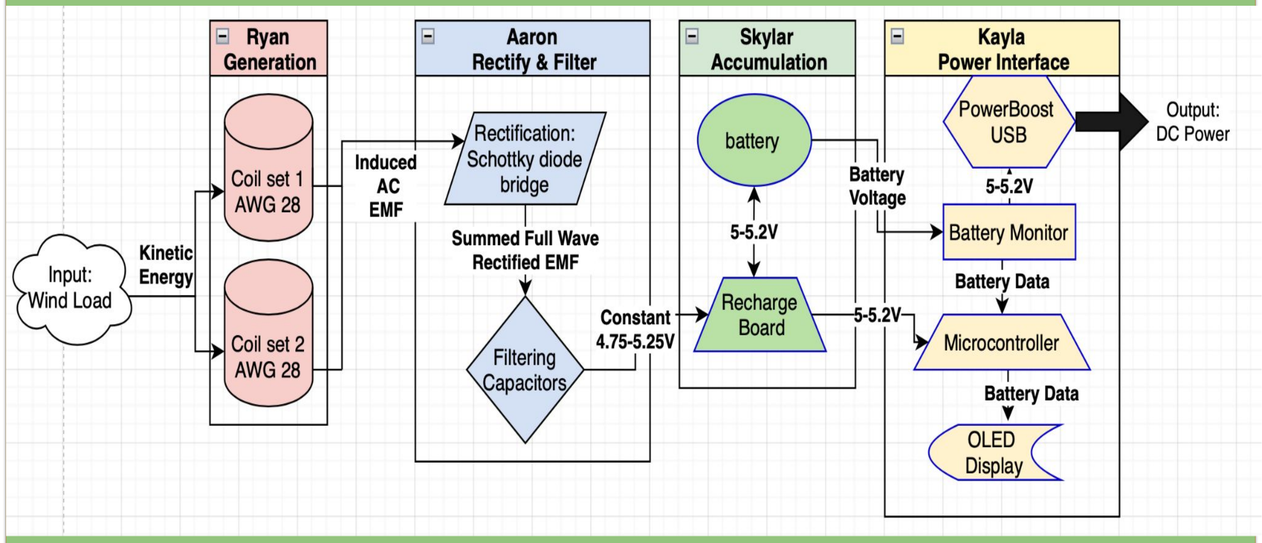
Coil #2:
1100 winds harder to turn more effective easily turned on diodes.





System Flow

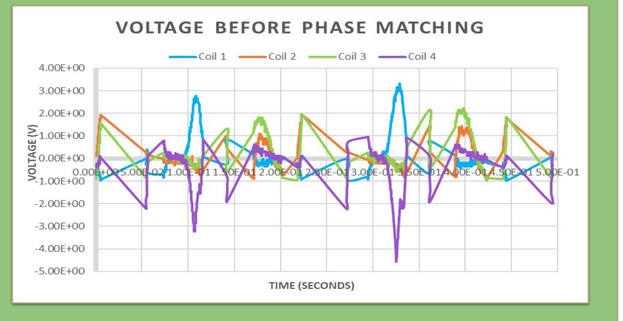
The Wind Vortex project is a clean power generator. Wind Vortex is designed to function in four different parts; Generation which will generate an AC signal, Rectification which will convert AC to DC, Accumulation to store the power, and the Power interface which distributes the power to an USB 3.0 port. Wind Vortex generates power by rocking a magnet over copper coils generating a flux according to Faraday's Law of electromagnetic Induction. The flux is then rectified and filtered before it's passed over to a battery for storage, which enables the distribution system to output usable power via USB 3.

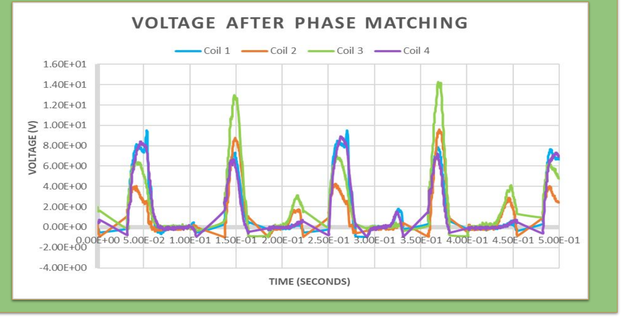


Generation	Rectification and Filtering	Accumulation	Power interface
Creating power using induction generation	Transforming AC waveform to DC	Storing the power	Distributing the power

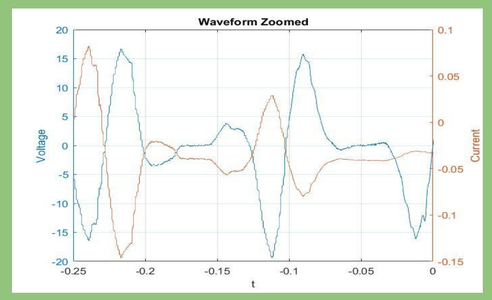
How did we determine generation?

1. Determine voltage range/Method:
   a. Induction
2. Design the coils:
   a. Faraday's equation for Electromagnetic Induction
   b. Pick Magnets
   c. Wrap Coils
3. Optimization:
   a. Distance of Magnets to Coil
   b. Coil Arrangement
   c. Phase Matching



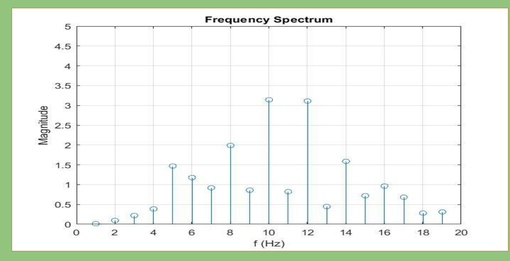


Testing and Progress



Waveform Voltage and Current vs Time

The above figure is the voltage and current waveforms across the coils arranged for maximum power with no load connected. A 90 degree phase shift between voltage and current can be observed here. The primary frequency of this waveform is 2 times the input frequency, due to the coils passing over 2 magnets per ½ cycle.



Frequency Spectrum

The above figure is the frequency spectrum of the waveform to the left. Some noise is generated from vibrations and imperfections in the structure, resulting in a spectrum of frequencies other than the primary frequency from the magnets. When this happens, the power generated is called "Dirty Power," common in small scale power generation plants like gasoline generators.

Ideal Charging Conditions:
Voltage: 4.75 V - 5.25 V DC
Current: 0.5 A DC