E1.03 - Wind Vortex Generator
Power Shake

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Team

Meet the team!

Aaron H. Kayla A. (P.M.) Ryan F. Skylar R.

Team Member Subsystems

Kayla Adderley(Project Manager) - Distribution

Skylar Roath - Accumulation

Aaron (AJ) Holley - Rectification & Conditioning

Ryan Fassnidge - Generation

Goals & Requirements

- The requirements for D1 is to show generation. Our team will demonstrate induction generation through the manual rocking of our structure with the coils attached to an oscilloscope.
- Our goal for D1 is to utilize 2 quadrants of our structure allowing us to generate power from four induction coils.
- The requirements for D2 is to show generation, rectification, accumulation and distribution of power through a USB 3.0 port.
- Our goal for D2 is to have a fully 3D printed structure that utilizes all 4 quadrants, allowing us to generate power from eight induction coils.

What's the advantage?

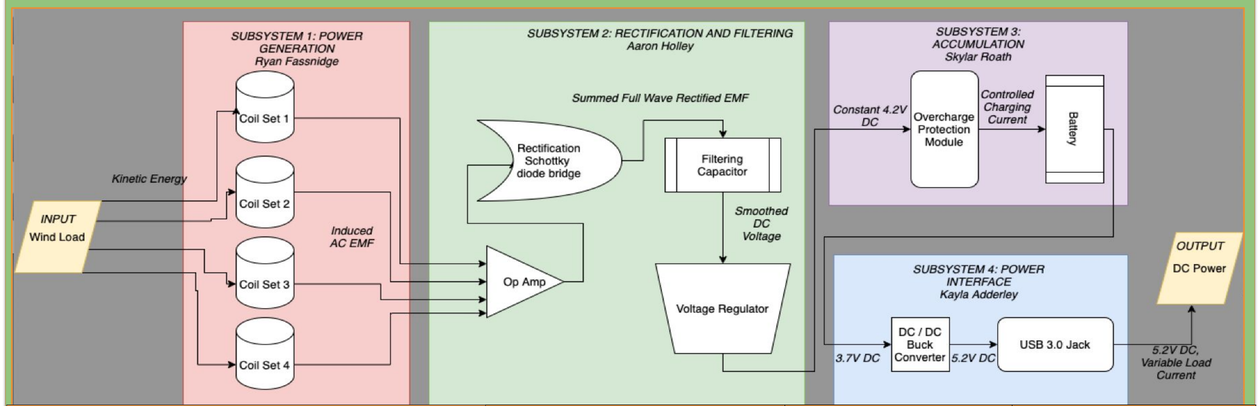
Typically wind turbines are noisy, deplete the bird population, and take up too much space. Our bladeless wind turbine is compact, produces no audible noise, and doesn't interfere with the bird population. As a bonus to this compact wind generator can be utilized more in urban areas where you can't use wind turbine generators therefore producing more green power.

What's the disadvantage?

The disadvantage to power shake is that it operates at low speed making the output low. Meaning the charging capabilities are limited to only relatively low power applications such as USB 3.0.

System Flow

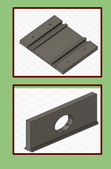
The Wind Vortex project is a clean power generator. Wind Vortex is designed to function in four different parts; Generation which will generate an AC signal, Rectification which will convert AC to DC, Accumulation to store the power, and the Power interface which distributes the power to an USB 3.0 port. 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.



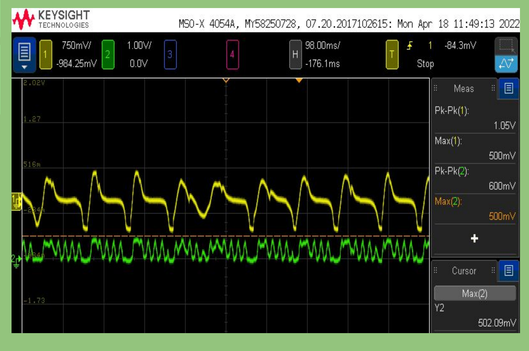
Generation	Rectification and Filtering	Accumulation	Power interface
Creating power using induction generation	Transforming AC waveform to DC	Storing the power	Distributing the power

How did we determine generation?

Mechanical



- The mechanical components of our structure consists of: a wooden base, Inner shaft, outer shafter, platform for the coil housings to sit on, 3D printed coil housings, drawer slides and U-joints.
- The magnets will rest on the drawer slides that are connected to the inner shaft. As the inner shaft rocks in a linear motion to simulate wind stimulation, the magnets will pass over the coils resting in their housings.



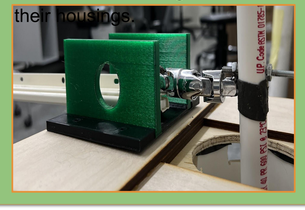
Electrical

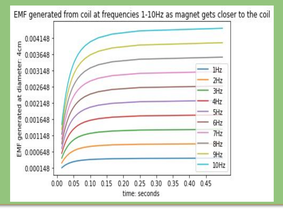
- Our initial plan for generation was the piezo crystals, The piezo did not work due to not being able to carry a strong enough current due to them having very low capacitance

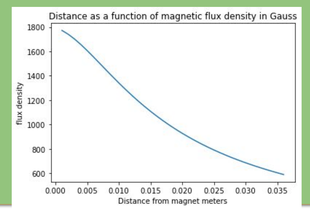
Process for designing induction generator:

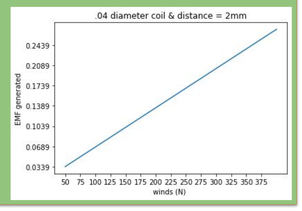
- Desired EMF
- Number of Winds
- Distance of the magnet from the coil
- Flux Density (area * flux)
- Change in Time
- Metal Core

$$\varepsilon = -N\frac{\Delta\Phi}{\Delta t}$$

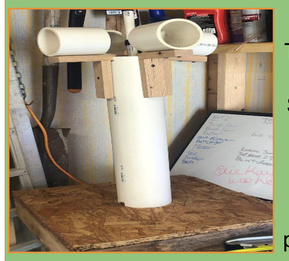








Prototype

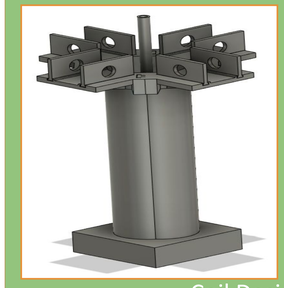


Model one

The figure on the left shows our initial model of Power Shake. In order to fine tune the distance from the magnets to the coils, we retired the cylindrical housing design for a 3D printed version, seen below.

Model two

The figure to the right shows the second and current version of Power Shake. There are currently CAD designs in the works to replace the wooden platform that the coil housings will sit on as well as the PVC outer shaft.



Model three

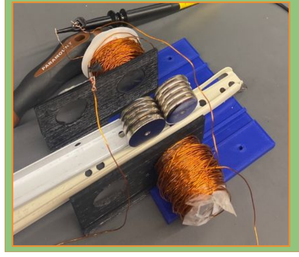
This will be our final design for the structure. It incorporates a professional look, cheaper manufacturing process and an overall weight reduction.

Coil Designs 1 & 2

Coil Design	Coil 1 22 AWG	Coil 2 28 AWG
Winds	270	1000
EMF 1-3Hz	0.61V-1.82V	1.27V-5.77V

Coil #1:

270 winds easier to wind less effective struggled turning on diodes.



Coil #2:

1000 winds harder to wind more effective easily turned on diodes.