TEXAS STATE
INGRAM SCHOOL OF ENGINEERING

Group M2.03 – Electric Field Mill

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Project Description

Our project focused on constructing an electric field mill designed to gauge the intensity of the atmospheric electric field. This project was an interdisciplinary effort between both Manufacturing and Electrical Engineering Senior Design teams. As the manufacturing team, our field of scope encompassed the mechanical components, including the rotating vane, shaft, motor, sensor plate, chassis, encasing, and support structure.

Background

Electric field mills have historically been used by NASA to predict lightning strikes as part of launch criteria to further protect their rockets and other scientific tools.

Outer Encasing

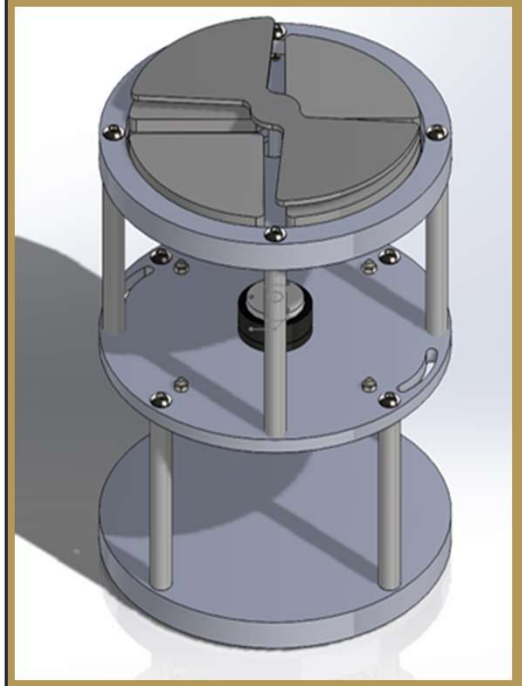
- Weather-resistant outer encasing designed meticulously for durability and functionality
- Built to withstand various environmental conditions
- Complements the intricate workings of the electric field mill
- Shape, size, and material selection optimized for performance
- Compact and efficient design maintained
- Electric field mill operates reliably
- Provides accurate measurements even in challenging weather conditions

Specifications & Mechanics

- Fully wireless data relay
- Rounded edges on all major components
- Waterproof from one side
- Base structure of electric field mill should be one person carry
- Constant 2000+ RPM step motor
- Self-sufficiently powered
- Ease of access to PCB and battery
- Deconstructable structure

An electric field mill with a rotating vane operates through electrostatic induction. As the vane spins in the atmospheric electric field, it generates a potential difference due to the separation of charges on its surfaces by constantly shielding an unshielding the electrodes or sensor plate. This induced potential provides a measure of the field's strength, offering a concise method for assessing the atmospheric electric environment.

Process & Design



Design of Inner Structure

Fabrication of Inner Structure

Process

- **Concept Generation:** Our main focus during this period was where to sit the electrical components in the inner structure; In terms of shape and size, a lot of our decisions were in response to constraints dependent on the electrical engineering team's design
- **Prototyping:** We created several different 3D printed models to verify that the needed electrical components would be able to fit into our design while still focusing on compactness
- **Fabrication:** Our main fabrication utilized the HAAS VF2 milling machine, necessitating custom-made jaws and machinist jacks in order to cut our stock. Later stages involved hand-machining with drills, bandsaws, and similar tools.
- **Material Emphasis:** Majority of our structure was constructed from aluminum, due to its requisite conductivity, lightweight nature, ease of machinability, and inherent corrosion resistance.

Meet the Team!

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