

Virtual Design Review



Team 16 - Kite Generator

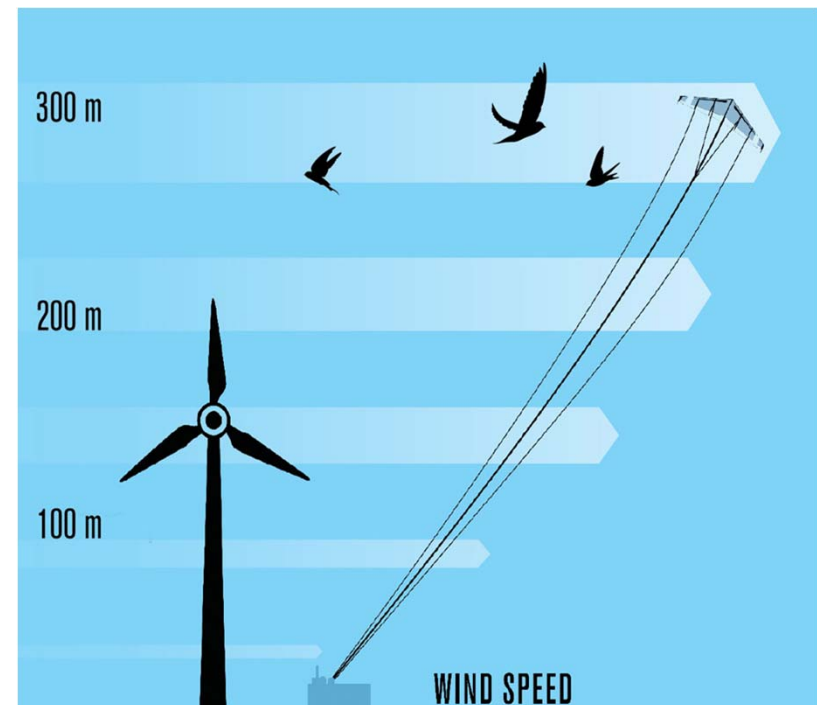
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FAMU-FSU COLLEGE OF ENGINEERING
MECHANICAL ENGINEERING

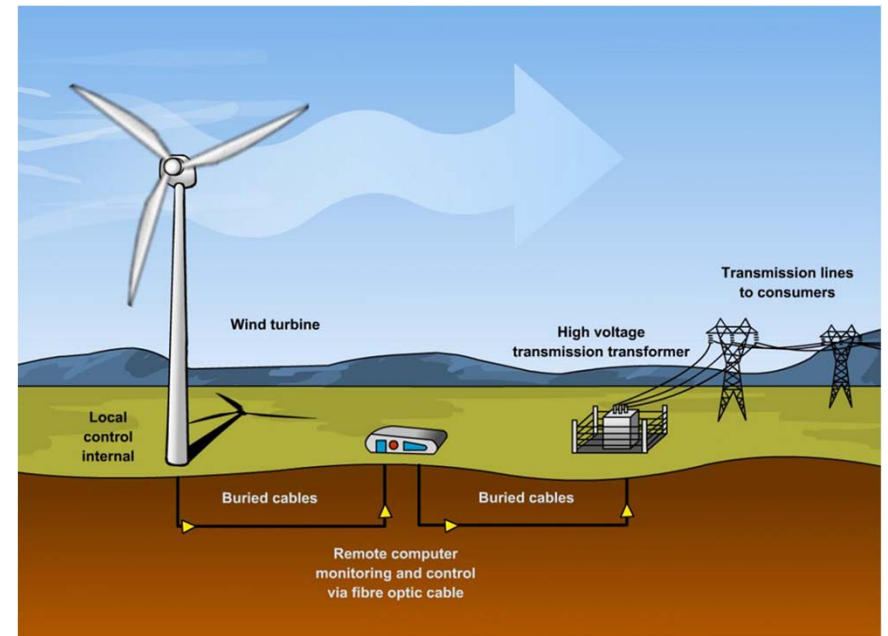
Introduction

- Wind power traditionally harnessed using wind turbines
- Problems with wind turbines:
 - Expensive to produce
 - Large fixed structures
 - Costly maintenance
 - Noise production
 - Varying wind speeds at fixed height
- Need for portable power generation
 - Remote, off-grid land areas
 - Disaster relief
 - Underdeveloped countries



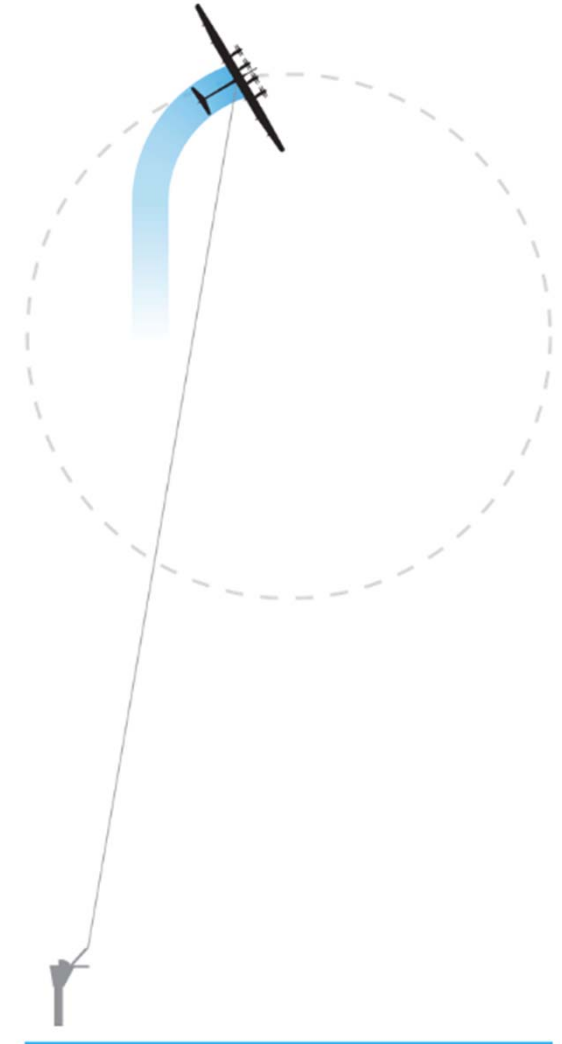
Project Summary

- Provide affordable power to rural, off-grid locations.
- Harness wind energy at a low cost and without permanent construction
- Limit amount of mechanical parts, less maintenance.
- Maneuverability in varying wind conditions.



Background

- Makani Power Company
 - Google owned power company
 - Makani's first commercial-scale energy kite
 - <https://www.youtube.com/watch?v=An8vtD1FDqs>
- Multiple Patents
 - Strain gauge tether delivering electrical charge
 - Rotating drum storage of tether
 - Hover and crosswind flight control system
 - Exclusive kite and bridle design



Background

- There are other companies using kites to harness wind energy:



Skysails

- Can be installed on offshore foundations, floating platforms, and onshore surfaces
- Underwater support platform for depths of down to 700m

<http://www.skysails.info/english/>



Altaeros energies

- Aerostat which uses Helium to stay aloft
- Reaches 600m for consistent winds
- Rapid installation from standard shipping containers

<http://www.altaiosenergies.com/technology.html>



Previous Design

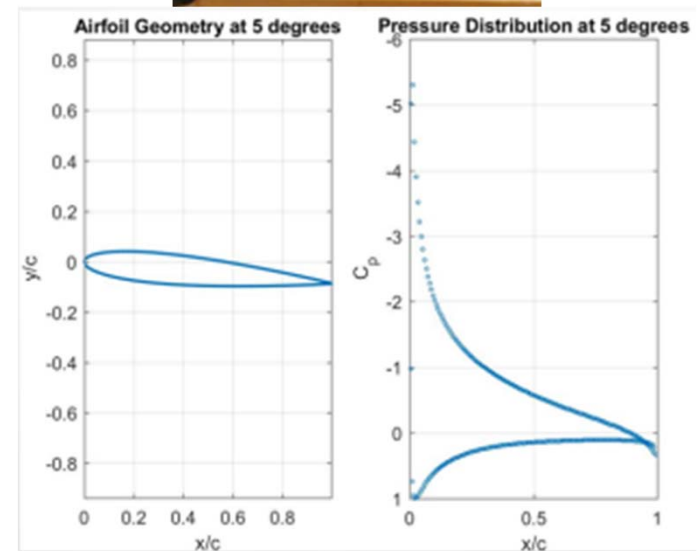
Prototype of Patent

- Designed to power 40 watt light bulb
- Inefficient and substandard design
 - Hand-wrapped copper solenoid
 - Use of duct tape
- Was not able to produce any significant power



No Kite Design

- Simulated kite movement by pulling rope attached to prototype
- Replicated kite movement with computer models



Project Scope

- Design an aerodynamic kite.
 - capable of autonomous flight
 - Sustain oscillating flight patterns
 - attached to a grounded tether.
- Convert oscillating kite flight path into electrical power.
- Use off the shelf parts and available technology
- Safe operation under varying wind speeds
- Adjustable for fine tuning the power generated
- Markets:
 - Disaster relief
 - Underdeveloped and developing countries
 - Commercial Agricultural



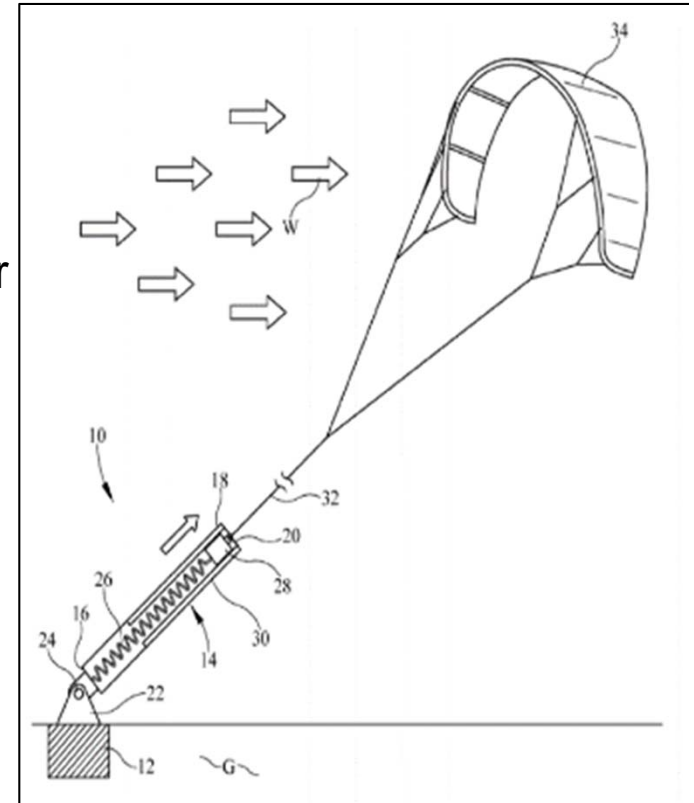
Customer Needs

Design aerodynamic kite

- Constructed of durable material
- Kite takes off and lands by operator command
- Kite sustains flight
- Fly kite in optimal pattern based off real time weather conditions
- Tether load is dispersed evenly along the kite wing.

Utilize Jeff Phipp's Patent

- Design patent for suitable power generation - 10kW
- Convert kite's mechanical energy to usable power
- Optimize power output based off of kite's movement



Functional Decomposition

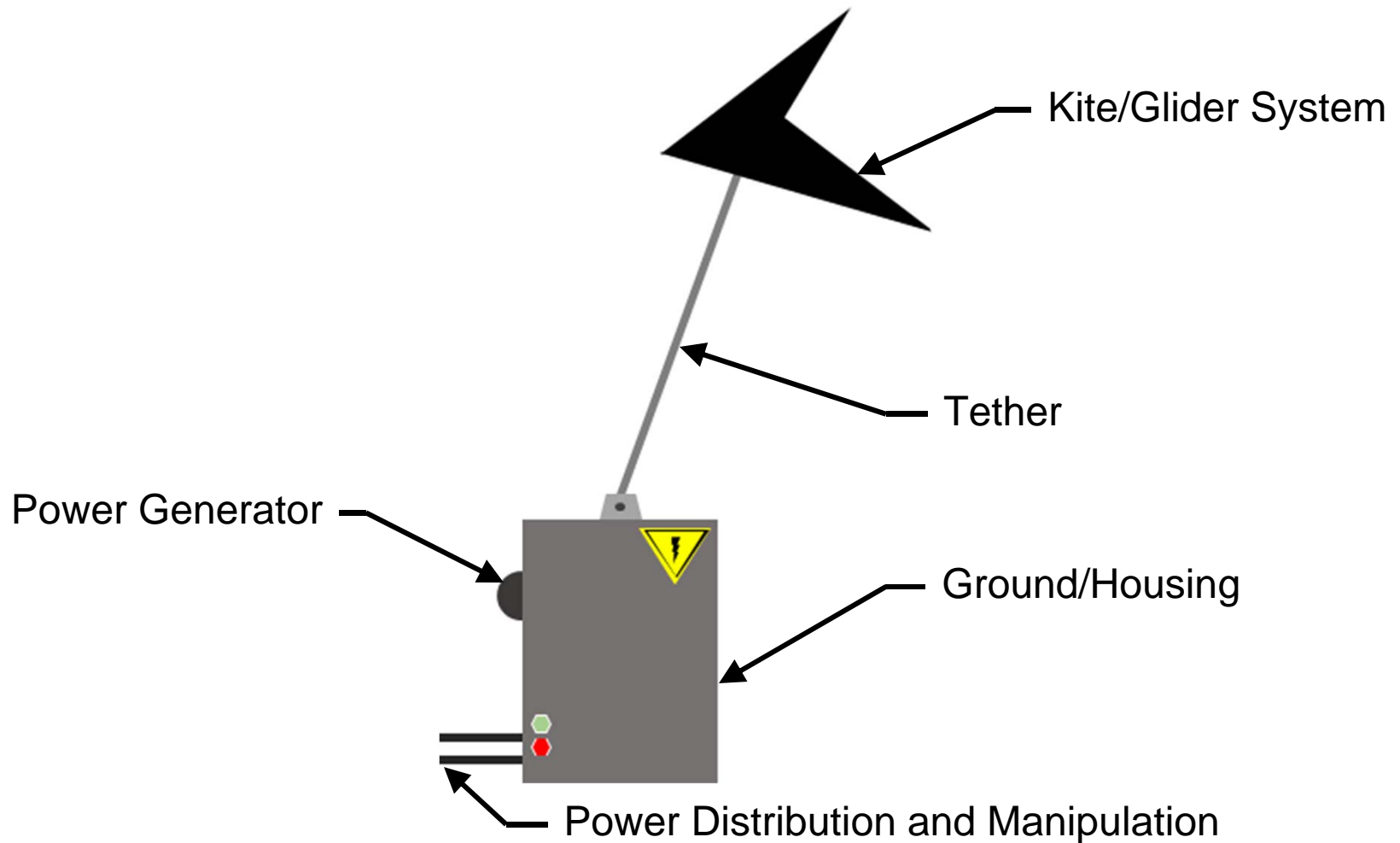
Components of Kite Generator System:

- Ground
 - Constrain housing to one location for an undetermined amount of time
- Housing
 - Rotate spherically with the wind direction
 - Protect the sub-system generating power
 - Attach and disconnect from ground and tether
 - Convert to usable power
- Tether
 - Fasten securely to both housing and kite
 - Expand and contract based off of wind conditions
- Kite
 - Takes off and lands autonomously
 - Flies in optimal pattern based off of weather conditions
- Sensor
 - Convey instantaneous wind speed and altitude of kite.
 - Measure tension on tether line.



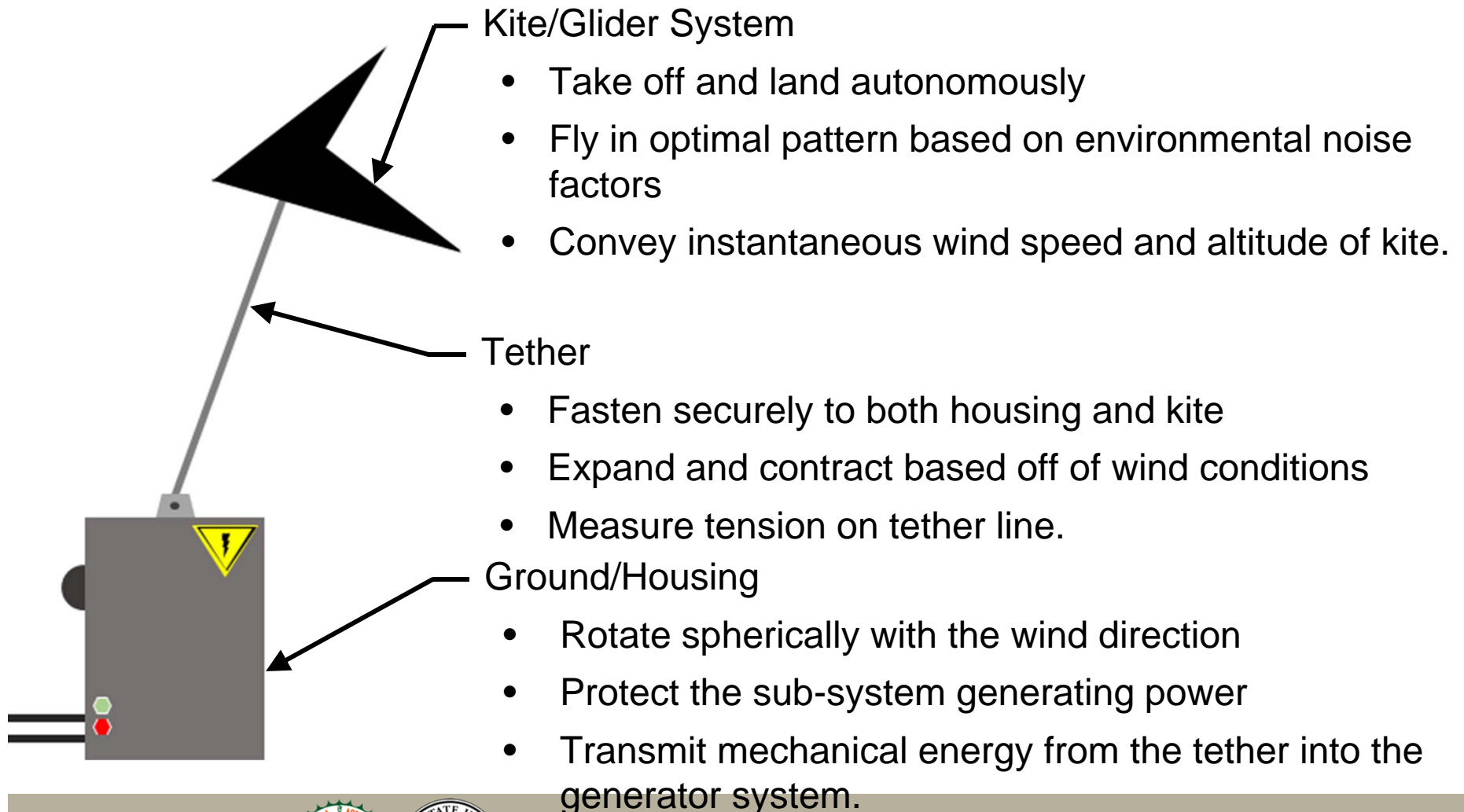
Functional Decomposition

Primary Components of Kite Generator System:



Functional Decomposition

Major Mechanical Systems:



Functional Decomposition

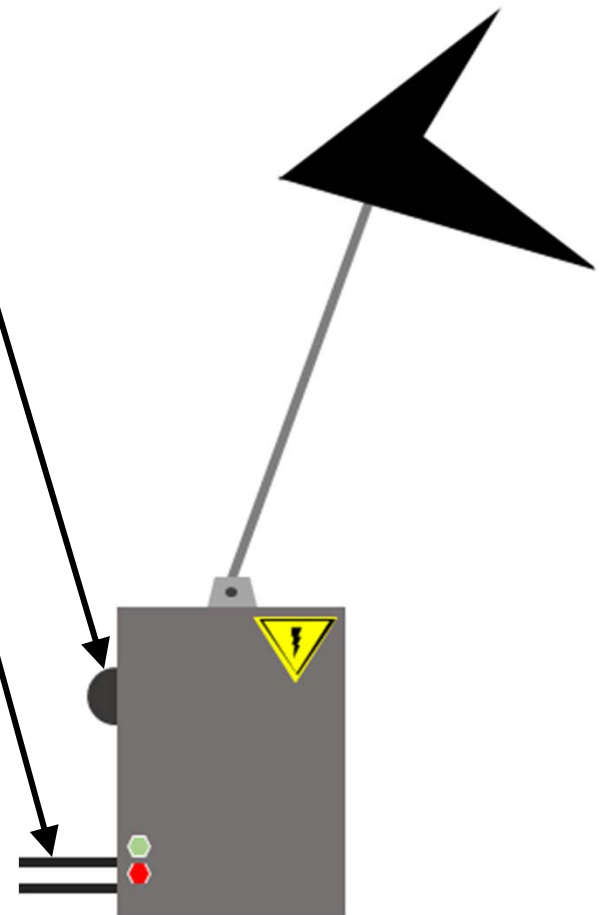
Major Electrical Systems:

Power Generator

- Convert mechanical motion into electrical power.

Power Distribution and Manipulation

- Convert messy electrical output from generator into a clean form (constant DC/sine AC).
- Transform voltage
- Safely ground dangerously high voltages



References

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