Executive Summary

Modern campers rely on electronics to navigate, survive, and document their adventures away from civilization. They need a way to charge their devices in the wild.

Problem Statement: Design a small-scale wind turbine capable of charging 2 phones, a flashlight, and a camera battery overnight.

Electrical Subsystem

- Stepper Motor Generator converts torque to electricity
- Bridge Rectifiers convert AC to DC to charge a battery pack
- Capacitors to smooth rectified output
- A Voltage Regulator stabilizes the power input to the battery and protects from overcharging
- Battery Pack charges 4 devices with USB cables

Mechanical Subsystem

- Vertical Wind Turbine can operate at low altitudes and low wind speeds
- Three Curved Savonius blade design is the most efficient
- Nylon Fabric blades are strong, lightweight, and collapsible for storage
- Aluminum Skeleton for high strength and lightweight
- Spring buttons for detachable blade arms
- Telescoping Shaft for easy extension and assembly
- Tent Spikes and Cables for lightweight structural support
- Gear Belt Drive to increase RPM at the generator

Future Recommendations and Improvements

- Purchase a voltage regulator that can improve average turbine power output
- Using a smaller stepper motor that weighs less than 2 lb and requires less than 0.27925 N*m of torque to turn
- Use a battery pack with lower internal resistance or higher maximum voltage input
- If a group chose a drag-driven blade design, we recommend increasing the size of the blades.
- Using bearings with less friction
- Consider a design where there is no gap in between the blade and the rotating shaft.

References


