

Wind Turbine Blade Design Final Report

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1. Objective

The purpose of this project is to design, prototype, and test a wind turbine blade using SolidWorks and 3D printing. The turbine's effectiveness was measured by the electrical output and its ability to lift a load.

2. Design Process

The design and prototyping process was completed in three stages:

Step 1: Fit Test

A simple blade was modeled and printed to test if it would fit the motor shaft. This initial prototype did not aim for performance but rather to validate mechanical compatibility.



Figure 1: fan test 0

Step 2: Size Adjustment

In the second attempt, a functional blade design was modeled, but the size was too small. While the design was closer to the final version, it lacked the surface area needed to generate sufficient torque.

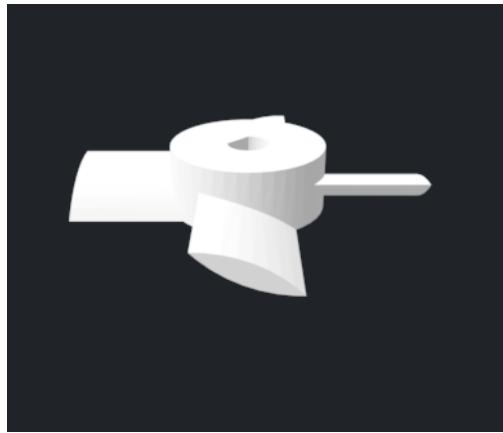


Figure 2: fan test 1

Step 3: Final Design

The third model had improved dimensions and fit well on the motor shaft. This final blade was printed and used for all performance measurements.

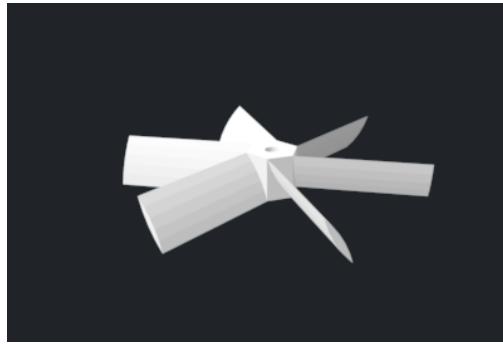


Figure 3: fan test 2

3. Prototype and Testing

The final prototype was tested in the lab. A multimeter was used to measure electrical output, and the lifting performance was evaluated.

- Voltage: 1.35 V (Figure 5)



Figure 4: Final Blade Prototype

- Current: 0.23 A (Figure 6)
- Load movement: 20 cm in 16.81 seconds
- Calculated speed: $\frac{0.2 \text{ m}}{16.81 \text{ s}} = \mathbf{0.0119 \text{ m/s}}$

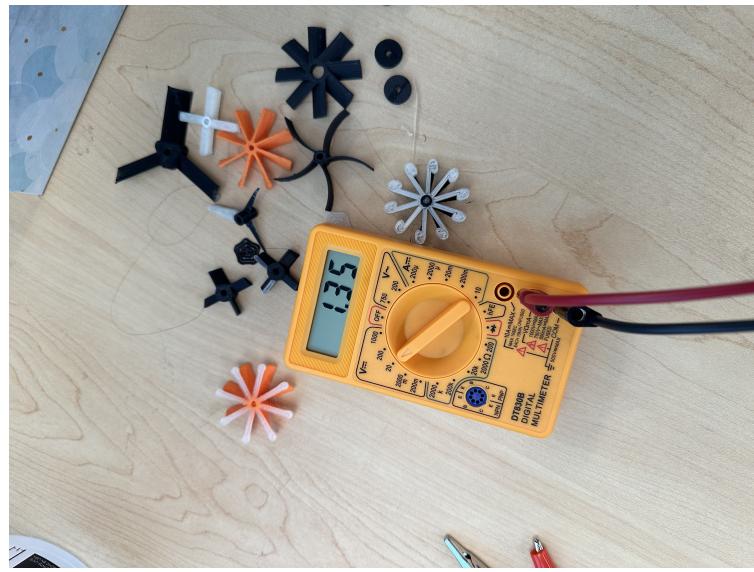


Figure 5: Voltage Measurement

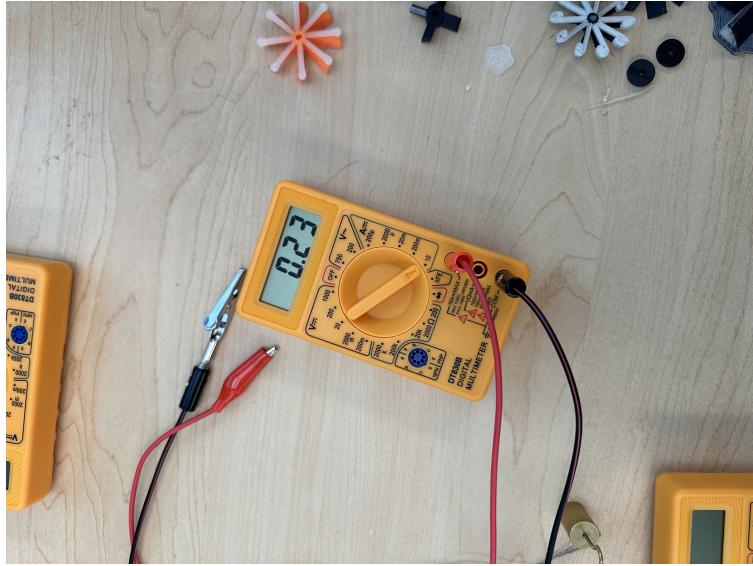


Figure 6: Current Measurement

4. Conclusion

The final wind turbine blade design successfully generated electricity and lifted a small weight. The design process involved iterative improvements through testing and redesign. Future improvements could focus on optimizing blade angle and aerodynamics for higher efficiency.