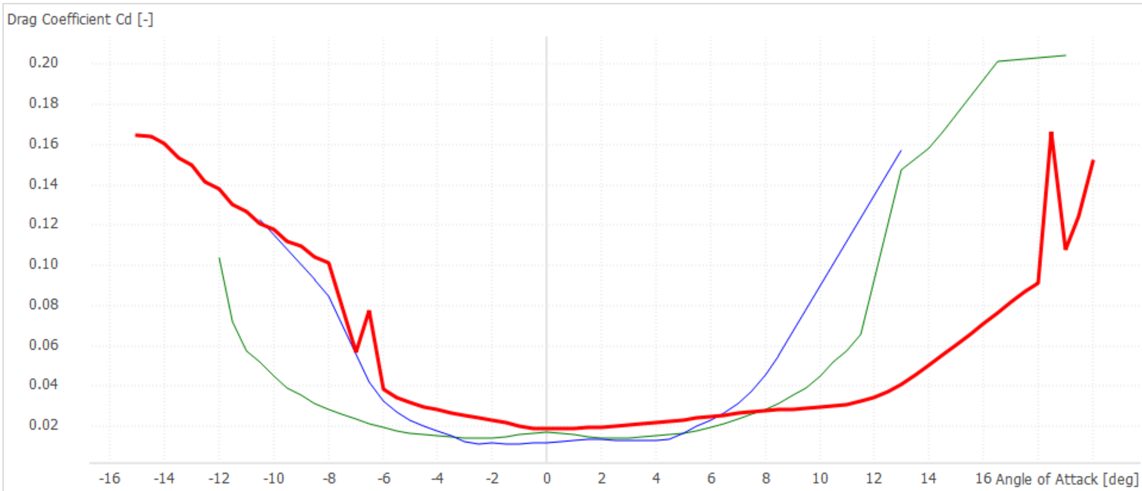
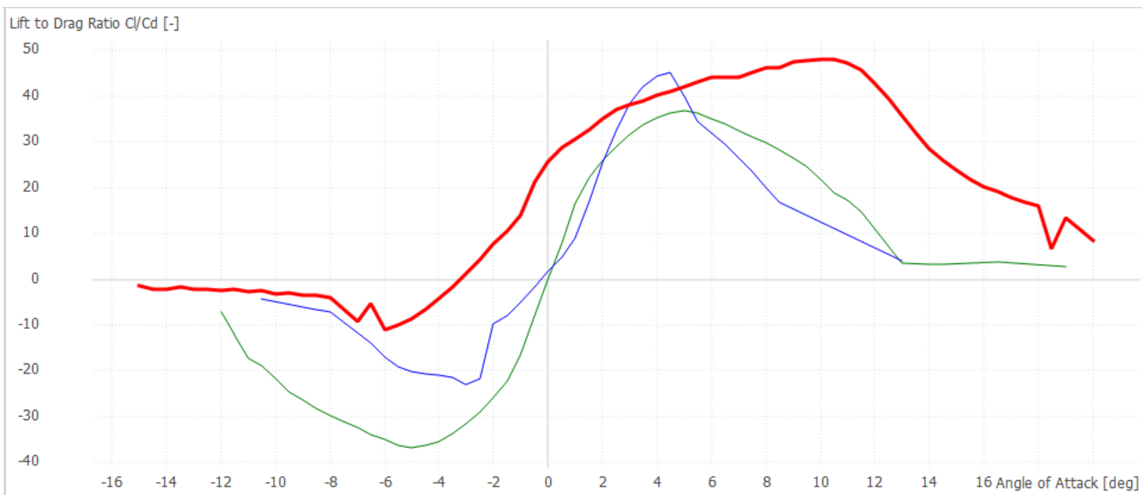
Project form

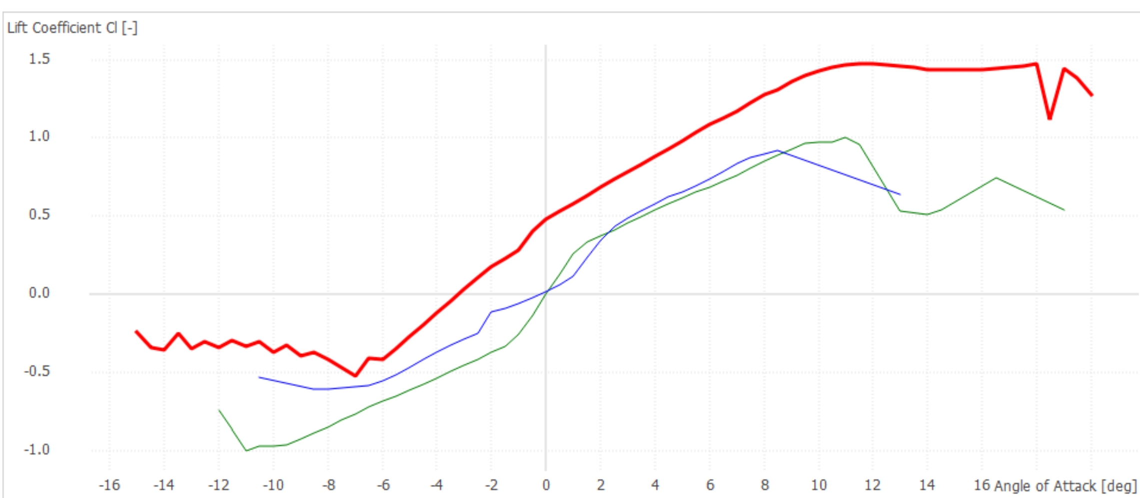
1. We are using a kidwind generator
2. DC, no
3. Yes
4. Yes
5. Yes
6. Yes
    a. Our gear ratio is
7. Max volts of 3.9V
8. The load was a 30 ohm resistor.
9. We used PLA for 3d printed parts.
10. The optimal pitch was 10-12 degrees.
11. 'The airfoils in our design is a NACA 4415 airfoil, and it was chosen due to it's very high lift to drag ratio.
12. We used Qblade to design and test the blades and fusion to add features like the rod that sits in the blade holder. Also used bambu studio to slice the model so it can be printed.
13. We used 3d printing to print out blades, gears and other parts that we need for gearing.
14. We used no capacitors.
15. No microcontroller used.

Process to choose blade

We used the software Qblade to create the blades and to choose the blades. We tried out multiple different types of airfoils with the same length, different airfoils that were best suited for wind turbines. We found two airfoils and tried the NACA 0012 to see how it compared to other blades because that airfoil is in whitebox, and we wan't to see if Qblade had an advantage to whitebox. After trying these three blades, one stood out and it was the NACA 4415 airfoil. It has the highest lift to drag ratio of all the blades, which means it will produce the most lift for the least amount of drag which is optimal for a fast moving blade.







The red line is the NACA 4415 airfoil compared to the 0012 and 1408 airfoil. As the graphs show, this blade tends to produce the highest lift as seen in the first graph and a still low amount of drag, although it is more than the other blades, it is still low. At about 10-11 degree AOA, the blade has the highest lift to drag ratio. We also decided to make the blade 12 inches long, because that makes the diameter 24 inches and the wind tunnel size is 36x36 inches. We printed one version of the blade but it was too thin and we also printed it with pegs that kept snapping off and the axle was printed with it and since it was printed vertically, it kept snapping off. So, we updated the model of the blade making the chord length longer on both the root and wing tip, and changed the print to print with dowels to improve connection strength and we glued them together. The blade might be a little short so in the future if we were to continue this project a longer blade would be better.

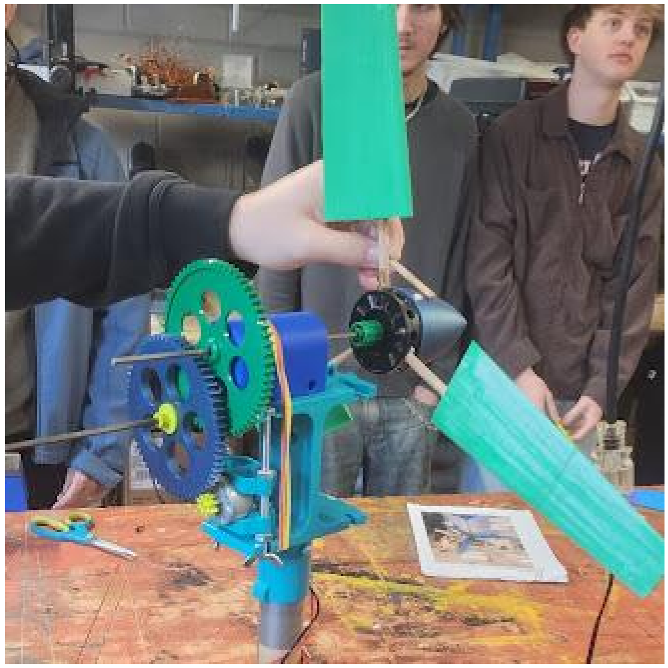
Process of designing the gear train

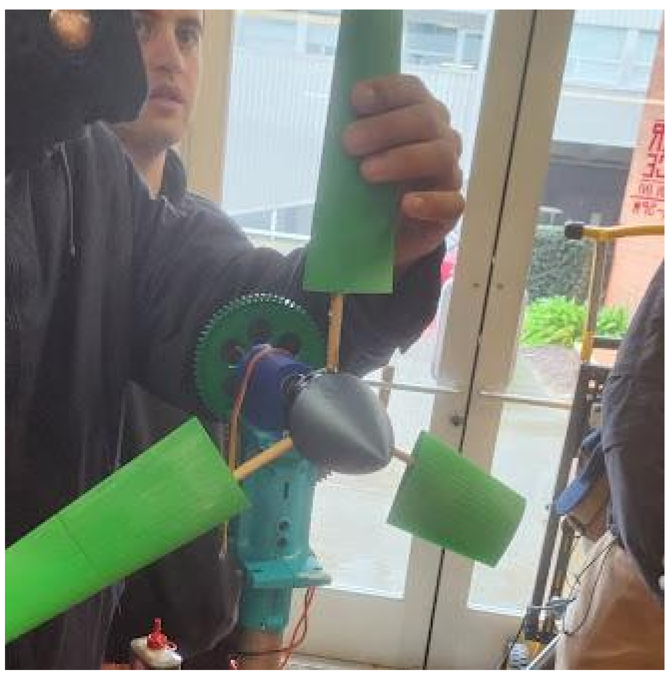
For the design of the gears we used the software Fusion 360 and I made a clone of the original gear. We modeled a 64 tooth gear with an 8 tooth attached to it in order to make a gear train. The gear train has a gear ratio of 64, and with a driver gear RPM of 10 it will translate to the final gear having an RPM of 640 this is calculated with:

RPM GEAR (Driven) =	RPM GEAR (Driver) *	GEAR RATIO
640	(10)	(64)

Compared to the stock turbine the gear train turbine the voltages produced was almost 6 times better than the stock and with stock wings with the stock generating 2.1 volts and the gear train producing 12.4.

Photos and Videos





Data

Speed setting	Voltage(V)	Current(mA)	Power(W)	Angle	Material	Size/shape	Gear type	Quantity
3 m/s	1.9	52	98.8	10 Degrees	Wood	Wood board	Standard gear	3
4 m/s	2.1	53	111.3	10 Degrees	Wood	Wood Board	Standard gear	3
3 m/s	NA	NA	NA				640 ratio	3
4 m/s	12.4	NA	NA	10 Degrees	Wood	Wood Board	640 ratio	3

STL files

Blade:
https://drive.google.com/file/d/10By5h0R52-lrlNz4CrpthqtkVI7y2LPB/view?usp=sharing

Nose cone:

https://drive.google.com/file/d/12BxL1xmuntVj-XdjIdm8bXBIU-rLcI5F/view?usp=sharing

Rod holder:

https://drive.google.com/file/d/1QfRy8dl-_NBvURuQU32vfp1rQX_600HG/view?usp=sharing

https://drive.google.com/file/d/1G_6dg5qnkJiO98Ikx07qAWBYlmvr-Z5-/view?usp=drive_link

---

Cites and Sources

Bambu Studio

Fusion 360

Qblade