Windmill Presentation

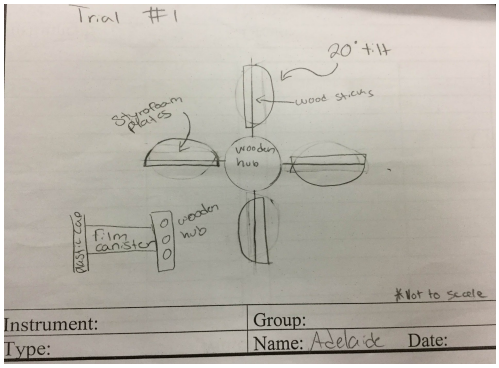
Team: GLAM Whales

GOAL:

The goal for this project was to design and create a windmill that generates power. The requirements for the project were that it had to be made of completely recycled materials and it had to fit on a bottle cap.

EXPLORE: When we started exploring our first idea was to use a plastic folder. We would cut the folder in half the long way and seal opposite corners to form a blade shape. We discarded the idea because the folder would be to hard to get in a short amount of time. Another idea was to use the top and curve of a Smart Water bottle as the blades but we decided that the design would not work. The last design we talked about was the ½ Styrofoam plates. We used that idea with the paper plates as our first design.

BRAINSTORM: After the brain storm, we had 3 possible ideas but only created 2. Our first design was made with 2 halves of Styrofoam plates glued together to make one blade. We put two together so that each blade would be more rigid and not break when we tested it. Our windmill had four blades so that it could catch more wind than if it had two. The angle of the blades was 20° so that the wind would push them. Below in Figure 1 is our sketch of our first design (a) and our first design (b).



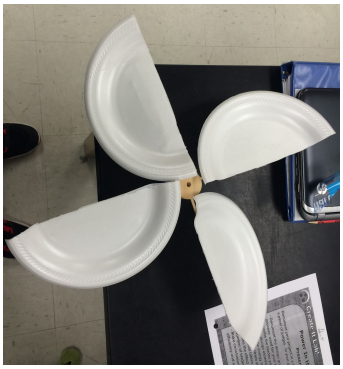


Figure 1. (a) Sketch (not to scale) and (b) Photo

This design produced an average of 1.1266 volts and 0.3266 milliamps. We couldn't measure wind speed at the same time as testing on this design because the blades were too close to the fan. This is not very much power so we decided to modify it to make our windmill better. For our second design, we decided to change the direction that the blades were pointed so that the lip of the plate would catch the wind and help the windmill go faster. Also we cut the film canister that held the blades more forward in half. In Figure 2 we have our sketch for our second design (a) and our second windmill (b).

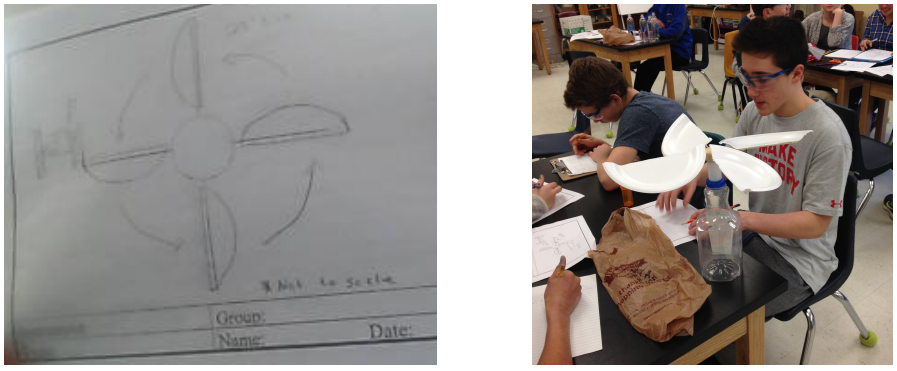


Figure 2. (a) Sketch (not to scale) and (b) photo

Our second design worked worse than our first one with an average of 1.1266 volts and an average of 0.3266 milliamps.

PLAN: Design B was chosen as the prototype. It was chosen because it was the fastest and one of the easiest to create. Also the smaller blades made the windmill lighter so it would spin faster

Materials Needed

- Bottle Cap
- Wooden Hub
- Small Wooden Dowels
- 2 Paper Plates

Tools Needed

- Hot Glue Gun
- Wire Cutter Pliers (Wood Cutting)
- X-ACTO knife

PROTOTYPE: The prototype design was constructed following the procedure outlined in the brainstorming session. We used hot glue to attach the bottle cap to the wooden hub. We used the glue again to attach the dowels to the hub in the pre-drilled holes. We cut the blades with an X-ACTO knife into a shark fin shaped piece. We included the curve the plate already had in our blade.

BUILD: The construction techniques were identical to those for the prototype. A photo of the finished unit appears below.

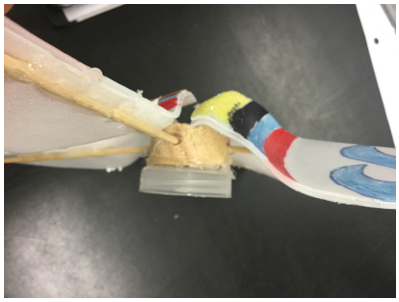


Figure 3 (a) Front view and (b) side view

TEST: After testing this design 12+ times it was very fast and efficient. We had no problems testing the final product. Final product is pictured in figures 3 and 4.

ANALYZE: Our original b design was ½ paper plates with a full film canister. But for B design we cut the film can in ½ so it wouldn't hit the wind speed tester as it did in design A. We tested that one but then made a small improvement on it. We cut the paper plates curve off to make it spin faster because we were not pleased with how fast it was before. We thought cutting off the curve would make it faster because the weight would be more centered. That test was still not fast enough so we cut the dowels to make it lighter so it would spin faster. For the last and final improvement we removed the film canister all together, reshaped the blades like a shark fin, and moved the blades closer to the hub to catch more wind.

CONCLUSION: The improved design was efficient and faster than all of the others. We had a 0.032% efficiency rate and were the 2nd best in the class. Our

final design generated 0.005 watts. If these fans were used to power a house it would take 266,667 fans to power 1 house for 24 hours.

FUTURE PLANS: In the future we would recreate to make the turbine better would be making it spin clockwise. In our first trial, our first turbine spun counter-clockwise and when we made it spun clockwise, it created more power than when we did it counter-clockwise. Also if we could make the angles all the same then it would do better because it would be more consistent and may produce more power. Also if we could make all the spacing the same for the turbines near the middle of the hub then it would also be more consistent and be able to catch the wind to produce more power.

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SOURCES:

Mogielnicki, J., D. Harmon, J. Kramer, D. Lyons, D. Lentine, D. Taylor, and MC Baker. *Power in the Wind*. *Create It Lab*. N.p., n.d. Web. Mar.-Apr. 2016. <http://createitlab.org/static/pdf/PinWind_V29Sb_L.pdf>.