**Introduction:**
A village in rural Outer Slombovia is located on a hill and thus needs assistance retrieving water. Our task was to create a wind-powered device that generates electricity to power a water pump that will carry water to this village. In order to simulate this scenario, our objective was to maximize the amount of water that can be pumped up a 6-inch hose in one minute.

**Design Plan:**
We wanted to be original so we chose a design more unique than the basic windmill blade. We modeled our design off of a Q5 wind turbine. We decided to stack very close to the design of the Q5, including the three-paged bases holding the three blades, and the idea of the turbine's ability to spin independently from the pole it's sitting on.

**Materials:**
- Wood
- PVC Pipes
- Water Pump
- Bucket
- Plastic Tubing
- Generator
- Gear
- Peg Board
- Hot Wheels Tracks
- Metal Rod

**Construction Methods:**
For the base, we decided to use a plywood base because it is sturdy and lightweight.

For the rotor blades, after cycling through several ideas including paper cardboard and a foam board, we eventually discovered that wheel tracks. We used them because they are lightweight, flexible, and have lips to catch wind.

Adding fins made out of foam board because they are also lightweight and increase the surface area hit by the wind.

We then attempted to make the Whirligig as sturdy as possible to maintain efficiency and reliability.

**Conclusion:**
Overall, our design was not very successful. Our windmill did not harness enough energy from the wind, and when we tried to up the power output with larger gear ratios, there was not enough torque to turn the generator. If we were to redesign this project, we would likely go with a simpler wind design which could harness more energy.

**Analysis and Results:**
Power available from the wind can be found using the equation $P = \frac{1}{2} \rho A v^3$, where $P$ is power, $\rho$ is the density of air, $A$ is the area of the wind, and $v$ is the wind velocity.

\[
p = \frac{1}{2} \rho A v^3 = \frac{1}{2} \times 1.204 \times (2 \times 9 \times 9) = 2286 \text{ m/s}^3 
\]

\[P = \frac{1}{2} \times 1.204 \times (2 \times 9 \times 9) = 65.1 \text{ W} \]

Power provided by the pump can be found by

\[P = (0.038 A) \times (40 \times 2) = 0.0152 \text{ W} \]

Efficiency of the machine was 0.0033 %

During the final testing of the Whirligig, we were only able to produce 0.04 and 0.32 W, for a total of 0.362 W of power that was harnessed by the Whirligig. Compared to the possible 160 W that can be harnessed by the wind, we harnessed only 0.004% of the total power input. This was not enough for us to be able to power the water pump, so we were not able to pump any water out of the tank.

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