ASME Student Design Competition: H2Go

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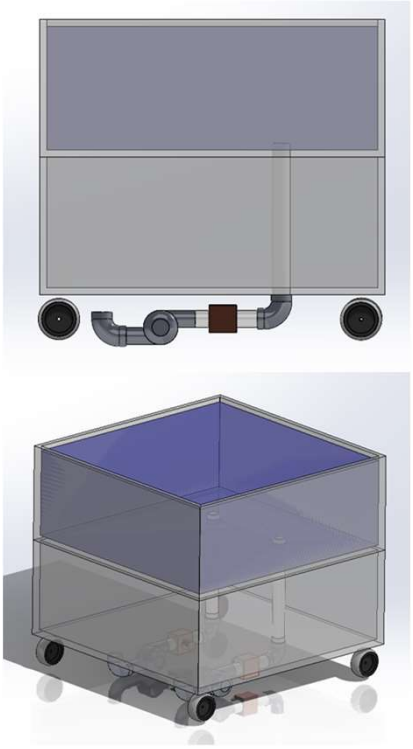
Obstacles:

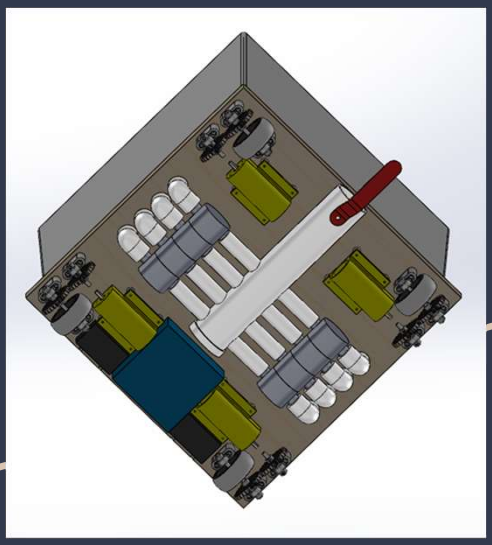
- The greatest obstacle was time. We joined the competition in January. The competition began in October, giving us a lot less time than other groups.
- Working efficiently we created a team, and began brainstorming ideas for our design. It was difficult to create a vehicle that was capable of converting steady falling water to a power.
- While we were designing we had to keep in mind our budget and the resources we had available.
- Lastly an obstacle we had to overcome was finding a location where can we test run this project that provides sufficient water without leaving a mess.

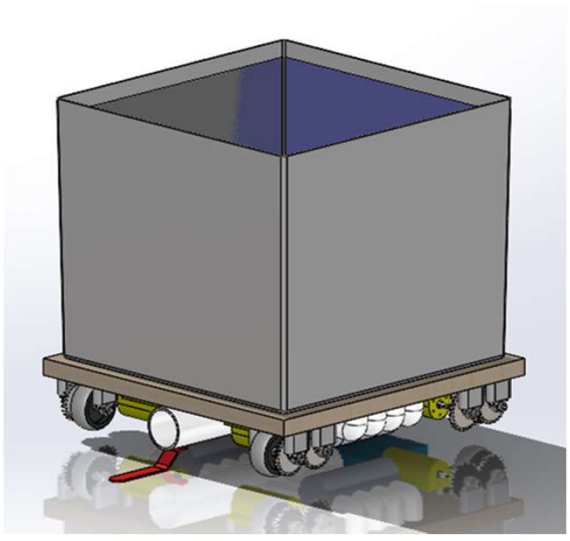
First concept:

- Initial design decision
  - Remote control movement
    - Arduino
  - Single round trip delivery, large quantity w/ bonus
    - Large tank
      - Wood base with vessel of allowed size
  - Generate energy by turbine
    - Store bought turbine
  - Omni Wheels
    - Flexibility of movement
    - Gearing on wheel motors



Second concept:





First test run:

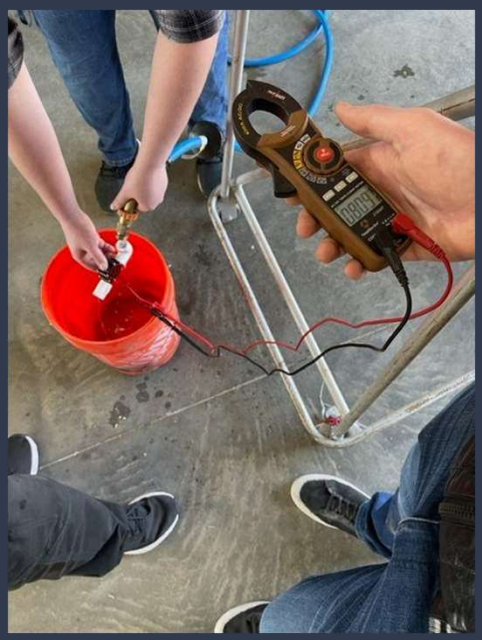
First test run was to get an idea of the total voltage output.

This was done by draining a 5-gallon bucket of water through a turbine. We connected the turbine to a multimeter to get an estimate of what power was going to be supplied by one turbine.

We read about 0.14mV, which isn't enough.

We needed to redesign the turbine.

Continued:



Obstacles And Revisions

Torque/gears for the amount of weight the water.

We decided to change from using a store bought turbine to our own 3D printed turbine.

Hook the turbine to a motor instead of having it be in a single assembly.

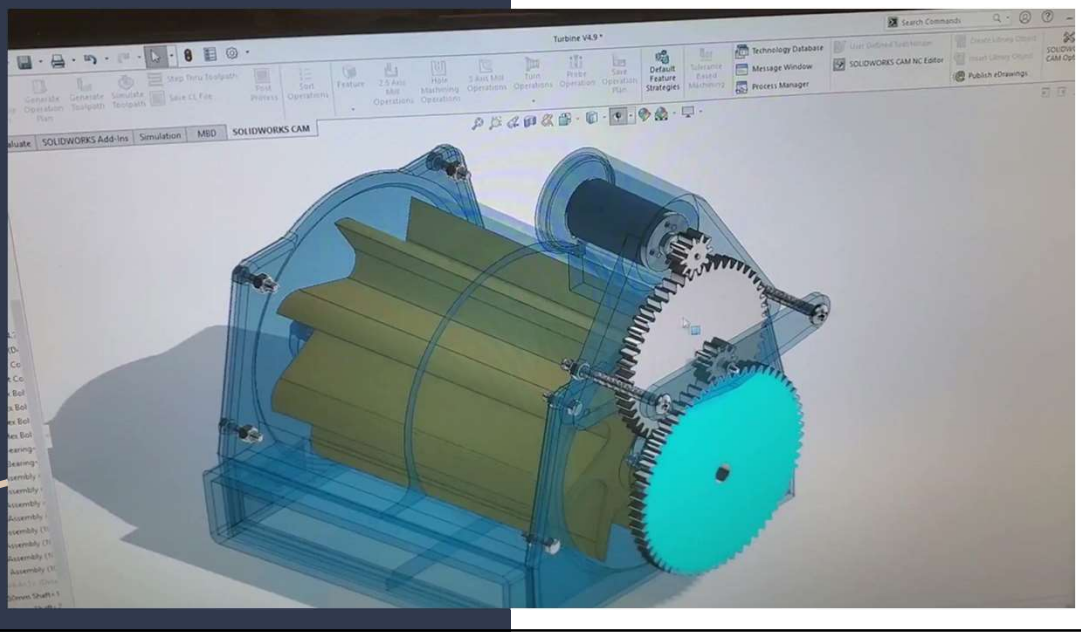
This required a design change to our tank. It went from a bucket to a trash can because we wanted a larger size.

Theory

We decided to take a more theory-driven approach for our third and fourth (final) concepts. We did an extensive amount of calculations including calculus, structural mechanics, circuit design, fluid mechanics, machine design, python, and more. 20 pages of hand-notes on engineering paper was needed to accomplish this. Through these calculations we found the perfect specifications to maximize power generation for the restrictions we were given for this competition.

Revisions made to turbine:

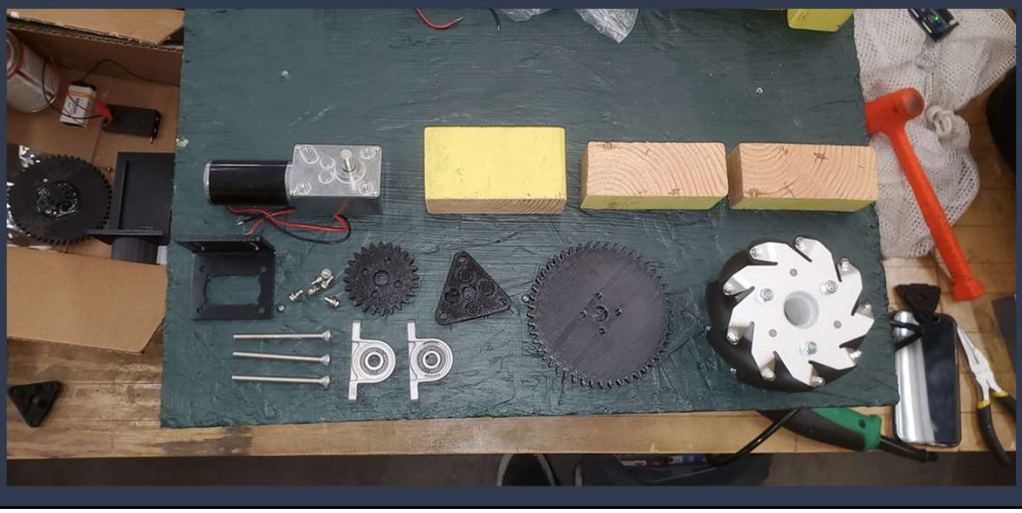
The first change was to the turbine. By 3-D printing the turbine we were able to control the size and gear ratio.

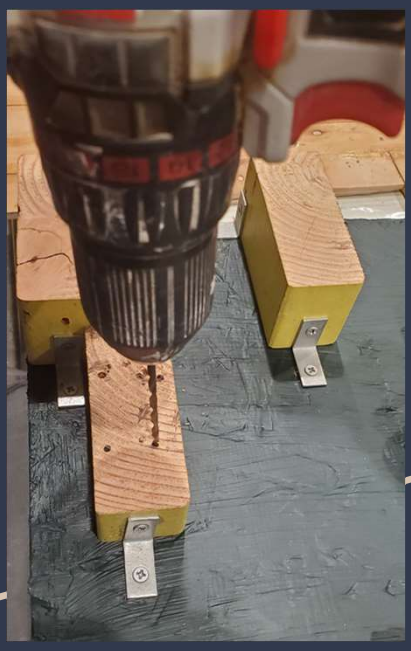


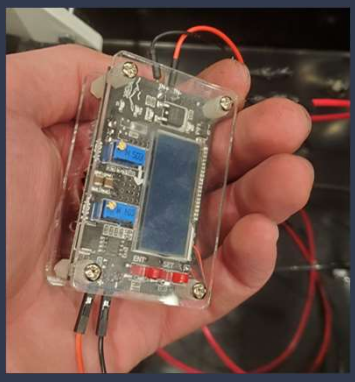
Turbine revisions continued...

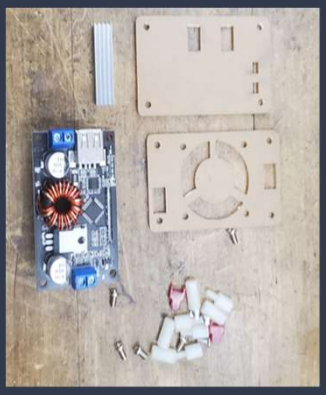
Designs for wheels:

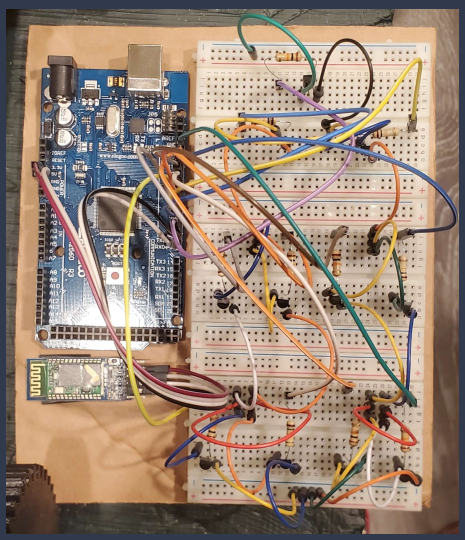
We decided to use omnidirectional wheels. This allowed us to drive forward, backward, make 0-point turns and move laterally (side-to-side). We also 3D printed custom gear trains to augment torque and rpm to desired specifications.





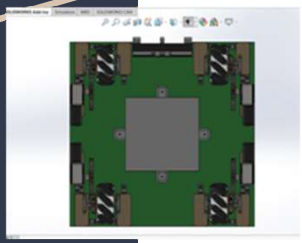




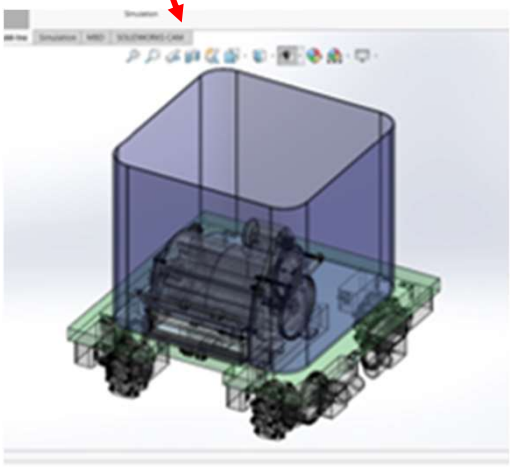


We used an Arduino MEGA to control our robot. Through an app on our phone, we could give the arduino input controls via a bluetooth module. The drive controls were powered by a fully-charged 12v battery. A voltage buck/boost converter was used to allow our turbine generator to charge our drive battery. A network of resistors and transistors were used to allow us to control steering and shut on/off our tubine during charging cycles.

Final CAD Design



400+ Part Assembly!



Final Draft and Design