



SWSSC Project

Design Tools II - Group 9

Cristina Chavez, Jed Cole, Jacob Michels

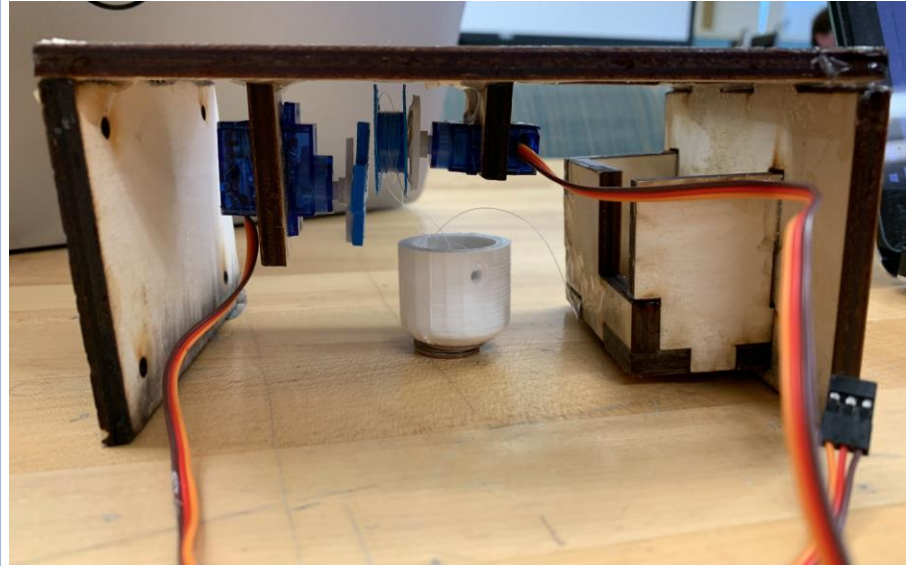
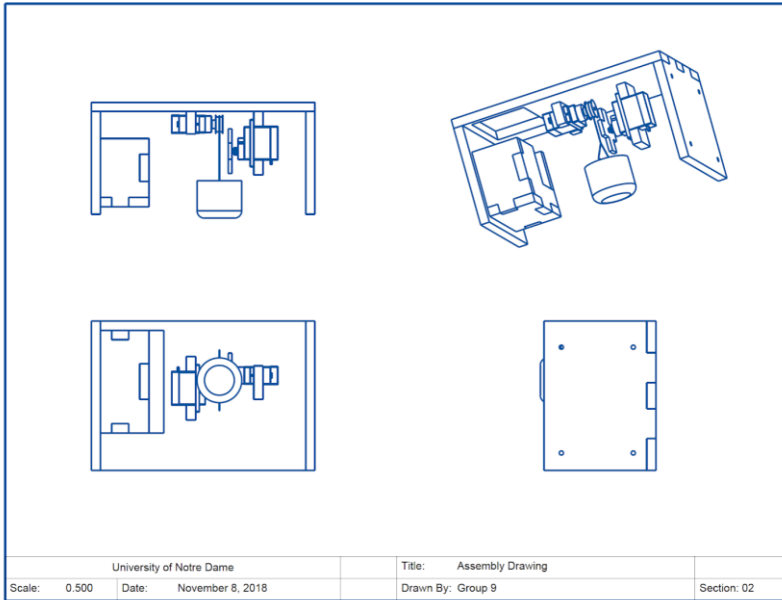
Design Statement

To design and fabricate an electro-mechanical assembly that mounts to a quadcopter and can obtain and record water samples.

Original Requirements

- Budget: under \$60
- Weight: under 1 pound
- Height: under 6 inches
- Depth: at least 12 inches
- Time: take a picture within 1 minute
- Number of samples: 4

First Build



How Well Original Requirements Were Met

- Budget - \$41
- Weight - 0.8 lbs
- Height - 3.5 inches
- Depth - much longer than 12 inches
- Time - much less than 1 minute
- Number of samples - 4



New Requirements

- 1) Untested sticks must remain dry
- 2) No servos near the water!
- 3) ONLY one strip should appear in each picture the camera takes
- 4) Strip should appear in a reliable position and directly face the camera without being blown by the wind for the photograph
- 5) Long “dangling” strings create hazards
- 6) Strips must be easily replaced between flights
- 7) All parts should be robust for multiple use
- 8) Maximum weight can be up to 1.25 lbs
- 9) Dip stick should sample from a contained space. Dipping into flowing water may wash off the chemical

New Requirements Not Met by Original Design

#5 - Original design used an uncontained, long, dangling string to move the bucket up and down

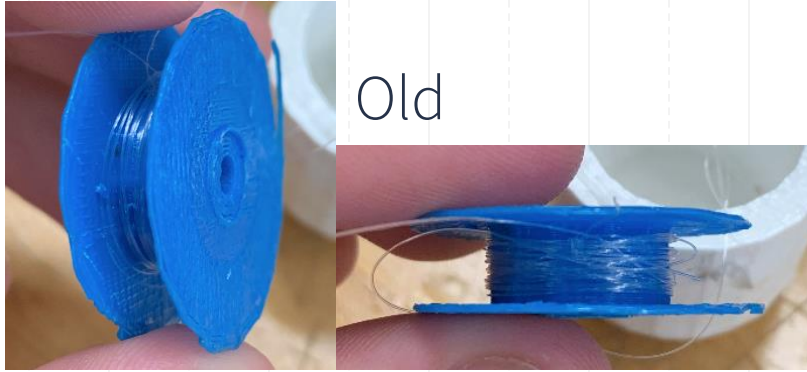
#6 - Original design had test strip holder that did not have a reliable method to secure strips in place (tape or rubber band)

Improvements

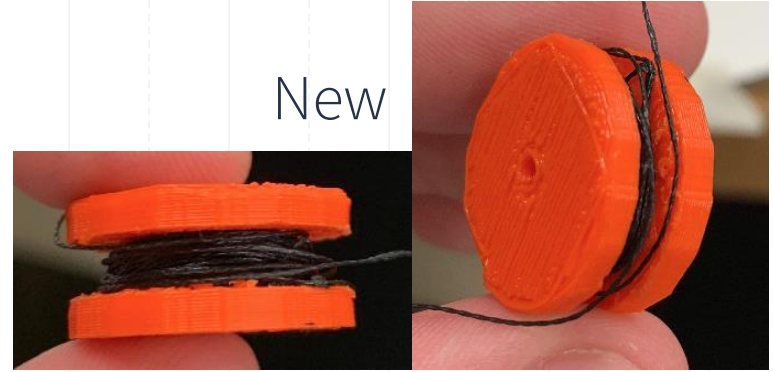
- Spool
- Test Strip Holder
- Bucket
- Telescoping Arm
- Center of Gravity
- Overall Size



Spool



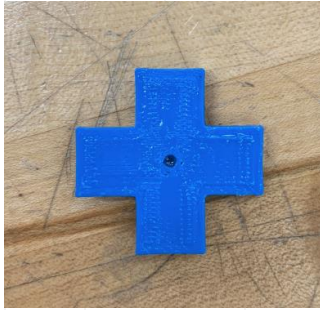
- Flimsy
- Larger than needed



- Compact
- Sturdy

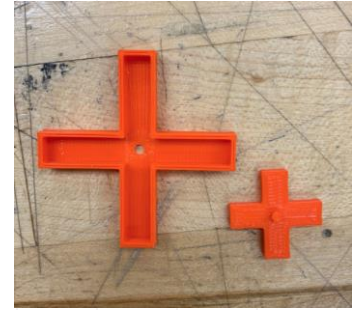


Test Strip Holder



Old

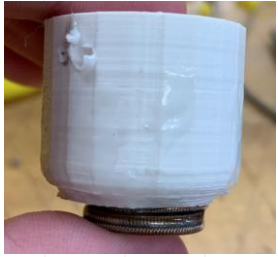
- No fastener
- Small
- Strips can easily fall off



New

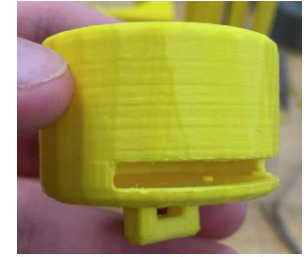
- Keeps strips in place
- Has fastener
- Sturdy

Bucket



Old

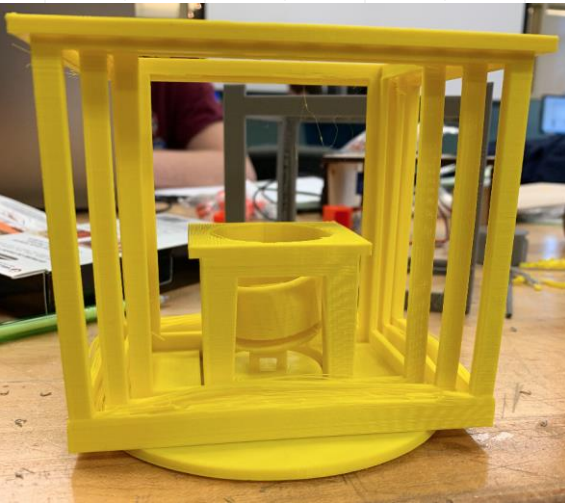
- Small
- Two holes
- Weights glued on bottom



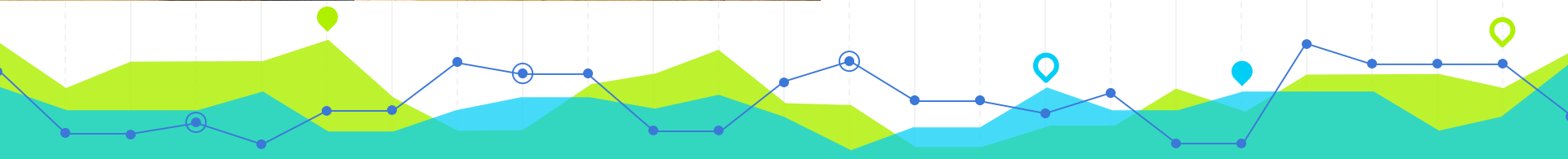
New

- Larger, carries more water
- Two handles for string
- Pocket for weights

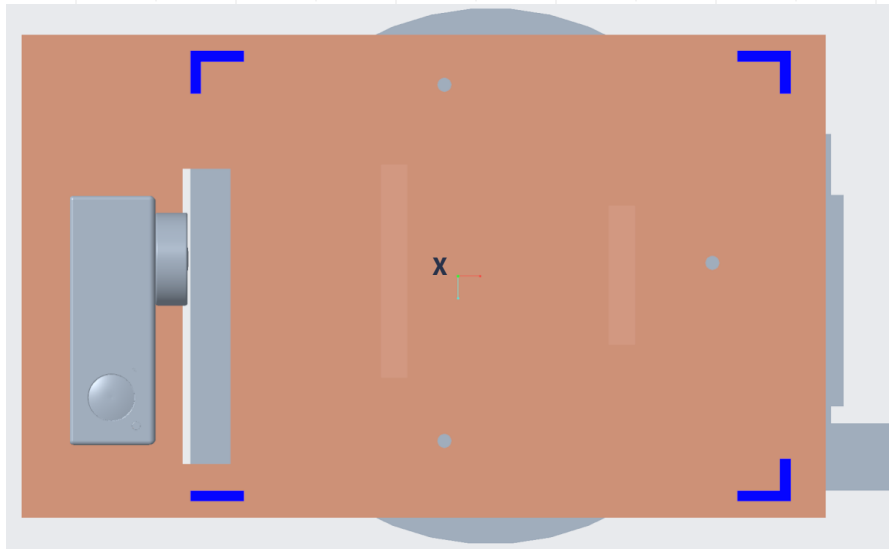
Telescoping Arm



- Replaces a long, dangling string
- Prevents swaying
- Keeps CG in the same place
- Compact when retracted

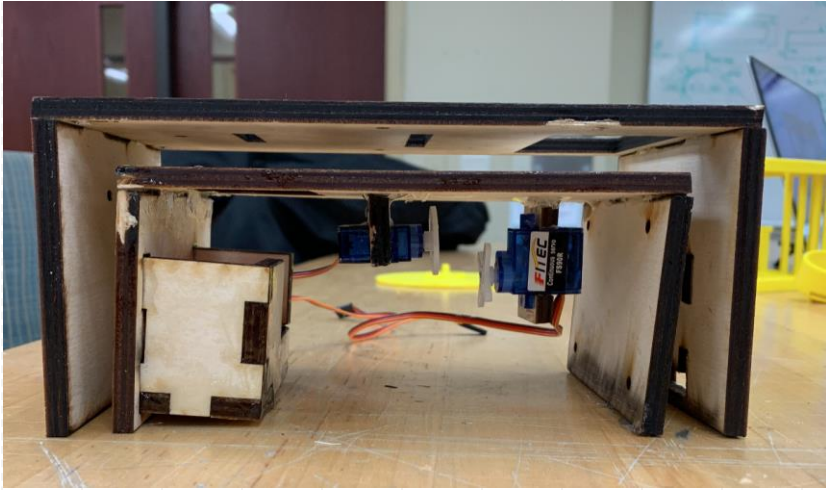


Center of Gravity



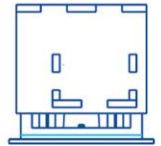
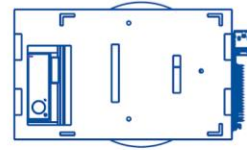
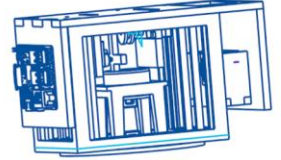
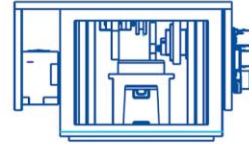
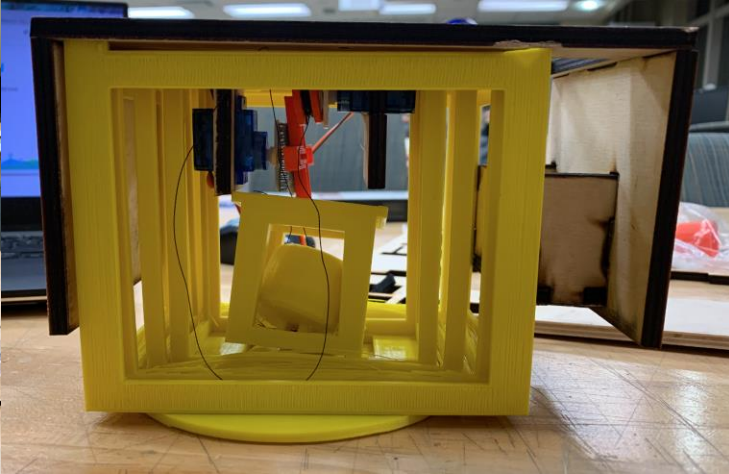
- Assigned material properties to each part in assembly
- Placed holes to coincide with CG of the drone

Overall Size



- Size increased to make room for telescoping arm
- Better spacing between parts

Second Build



How Well Requirements Were Met

Old Requirements

- Budget - \$51
- Weight - 1.22 lbs
- Height - 4.8 inches
- Depth - more than 12 inches
- Time - under 1 minute
- Number of samples - 4

New Requirements

- 1) Met
- 2) Met
- 3) Met
- 4) Met
- 5) Met
- 6) Met
- 7) Met
- 8) Met
- 9) Met



How Well Model Worked

- Effectively able to extend to collect water, retract, dip a test strip into bucket, and have a clear path for the GoPro to take a picture
- Met all the requirements
- Telescoping arm created a lot of friction due to the way it printed out
- Is a little difficult to get the bucket submerged
- Parts of assembly are more closely packed than originally thought

Possible Improvements

- Cleaner prints for telescoping arm
 - Possibly with a new material
 - Reduces friction
- Make frame a little bigger to create more spacing
- Telescoping arm retracts on its own without the need for a large disk
 - Would make it easier to get bucket submerged in water