In class, I made a bird with moving wings.

https://www.youtube.com/watch?v=B-V-dYD2INU


For my final project, I wanted to mimic the functionality of a 360 degree wheel with two 180 degree servos. Here is a chart that demonstrates how this works:
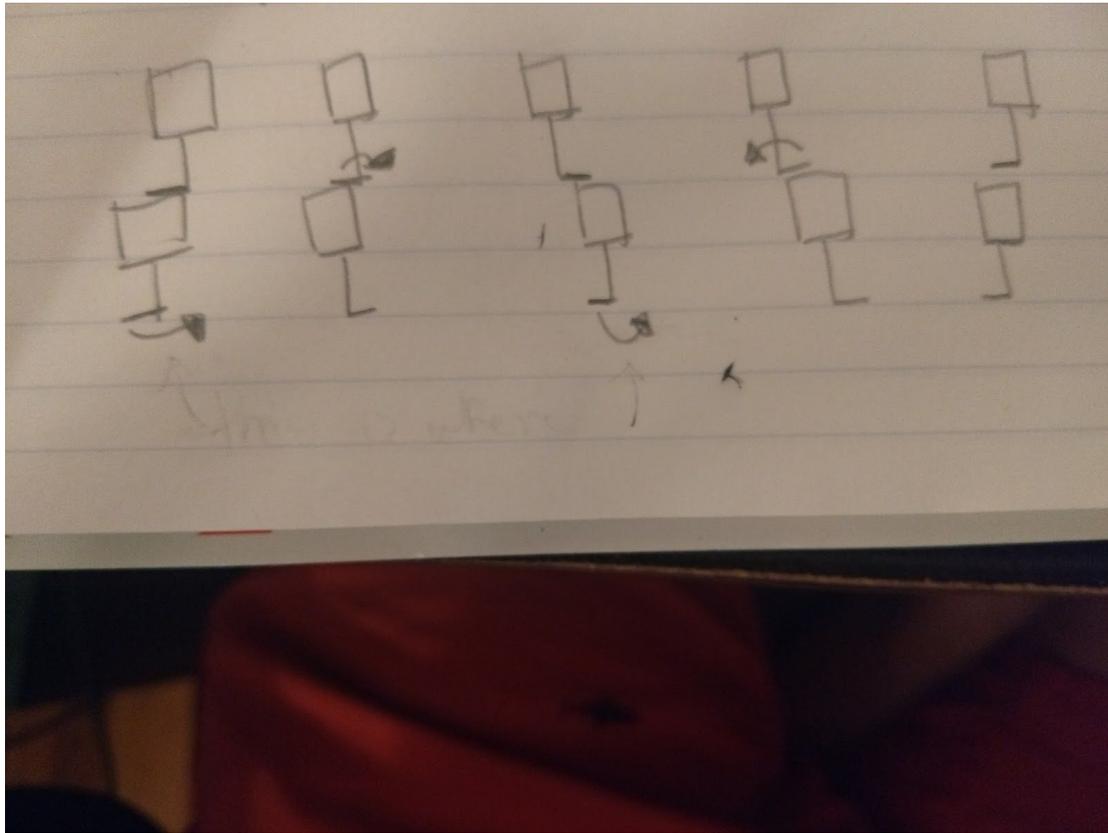
The bottom servo functions as the wheel, and goes from 0 to 180 degrees, then the top servo turns it 180 degrees so that when the wheel goes from 180 back to 0 degrees, it continues to move in the same direction. I decided to put this wheel inside a Roomba-inspired bot. When I was originally planning, I didn't really think about the fact that the Arduino would have to be plugged into a laptop, so I imagined that a Roomba would have enough space inside to hold an Arduino and breadboard so you wouldn't have to worry about wires.

For my initial prototype, I made a simple cylinder with a single base out of cardstock. I originally wanted to use popsicle sticks for a sturdier bot, but I realized that popsicle sticks aren't the ideal material for making a short cylinder like a Roomba. For the first iteration, I had the wheel servo moving 1 degree per 15 milliseconds, which is the speed used in the example code. The top servo moves 180 degrees with no delay in order to maximize the amount of time the wheel is pushing the bot forwards. I decided to make my wheel a semicircular cylinder rather than the traditional full cylinder. Since the wheel servo only moves 180 degrees, only half a circle is necessary, and I thought having a flat edge on the wheel might help the bot move on certain surfaces. I decided to leave the Arduino outside the bot to give it the most freedom to move despite being leashed to a laptop.

https://www.youtube.com/watch?v=BoNBdog1czk
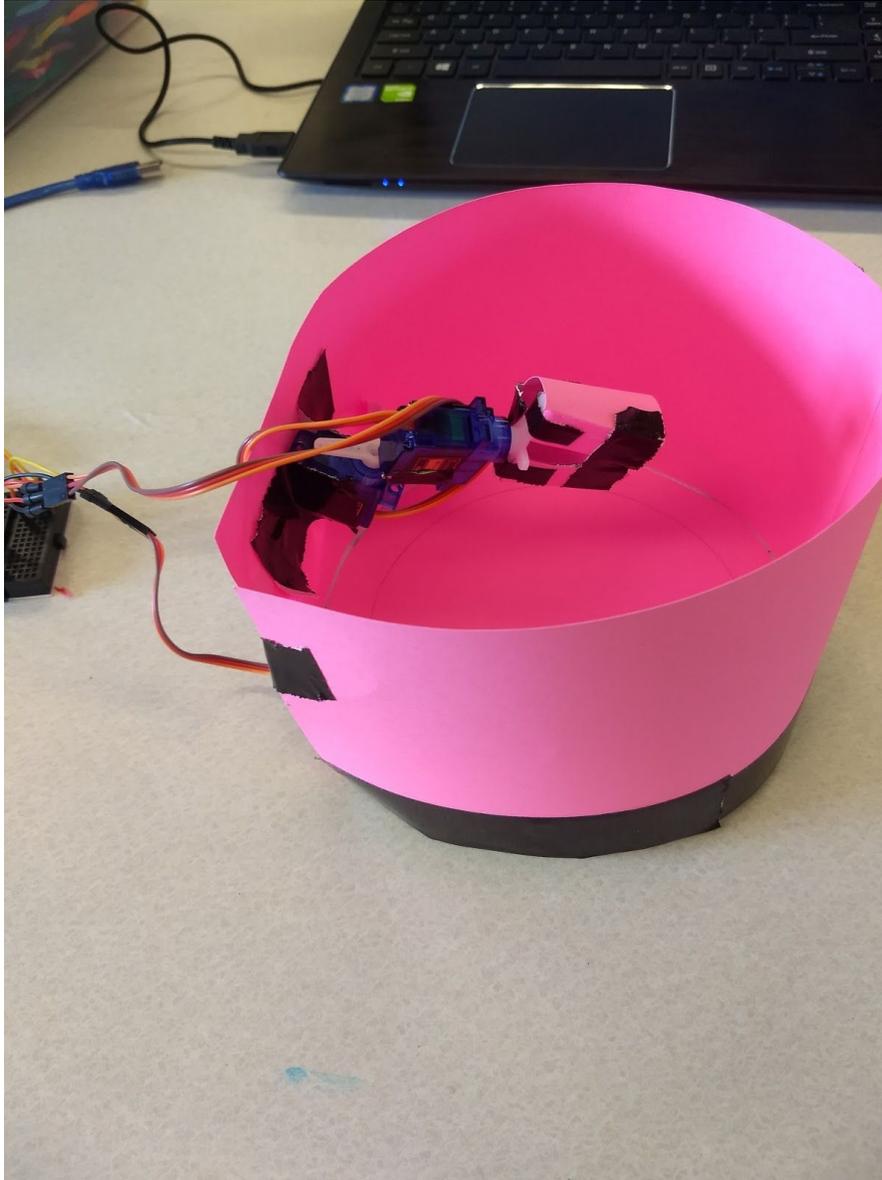
This prototype moved successfully! However, it was very slow and jerky, and the aesthetics left much to be desired. For my second iteration, I increased the wheel speed to 1 degree per 1 millisecond, reinforced the cylinder with black duct tape, and added pipe cleaners around the base. As the bot moves, the pipe cleaners should help the bot clean surfaces. I considered having the front of the bot be slightly off the ground, allowing the bot to trap dust or debris inside it, but there isn't really a "front" to the bot. Its wires are pretty short, so it often moves in a vague semicircle around the arduino/laptop. I considered grabbing some male-to-female jumper wires to give it more leeway, but doing that wouldn't actually solve anything. Here is a video of my second iteration walking off a table— unfortunately, it is not quite as smart (or as good at cleaning) as an actual Roomba.

https://www.youtube.com/watch?v=3kMh9glx-Fk

For my final iteration, I trimmed the cylinder to be slightly shorter, more closely resembling the dimensions of a Roomba. This also allowed me to stabilize the top servo against the top "roof" of the bot, making the bot's motion less jumpy. All of the prototypes have a bit of a back and forth movement due to the wheel touching the ground while the top servo turns 180 degrees, but with the servo stabilized, the edges of final prototype remain on the ground at all times, which enable the pipe cleaners to scrub the ground instead of hopping over it. I also taped the wires to the roof of the bot to keep them from getting in the way of the servos' motion.

https://www.youtube.com/watch?v=IX3W2UMoOOw

Overall I think my bot turned out well. It was surprisingly hard to get the physical logistics of everything to work out, for instance with getting the servo arms at the right angles and getting the servos at the right height in the bot to touch the ground.