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Adjacent Dual-Arm Micro-Servo

Our team was tasked with designing a dual arm servo with a single motor. We set goals to increase space efficiency within the device, have both arms provide equal torques, and have them both rotate in the same direction. Ultimately, we created our project with two arms on adjacent sides attached to the same gear by identical gear trains. Output was consistent because the gear trains were identical and attached to the same power source. We also maintained space efficiency because the overall dimensions increased only slightly. We also only needed one potentiometer to make the arms move at the same time because both gear systems are interconnected. As for both arms rotating in the same direction, we were able to accomplish this goal also because both gear trains are connected to the same source, which spins both in the same direction.

In terms of materials, we decided on keeping the plastic casing because it's affordable and effective in our main goals of the device. For purposes of our servo, the device won't be subjected to extreme conditions or forces, so plastic will be durable enough to maintain its structural integrity. The tolerance for the plastic casing is 0.05. We wanted to keep the gears light so it would have less inertia and thus allowing it to spin faster from the motor, so we decided on a nylon plastic material. The tolerance for this is 0.05. This material will be durable for the gears' rotating motions while not being too dense as to slow the servo's output. The rods will still be manufactured from metal iron, with tolerance 0.05. The metal will provide a strong connection between the gears to prevent weakening within the gear train, and the rods should be a class IV fit within the gears. The chip, motor, and screws will be manufactured separately.

In our actual design, we have three components to the casing, 2 gear trains each composed of 4 gears, 1 connector gear, and 4 rods. The bottom casing piece (D020) is from the original design, and it serves as a clamp for the wires to apply the servo. The middle casing (D019) serves as housing for the motor (not pictured), chip, and potentiometer. Finally, the upper casing houses the gears. (D003) illustrates the connector piece and its relationship to the two gear trains. We essentially angled the connector inward so that it could attach to both gear trains, and we used da Vinci's style gear to obtain perpendicular motion. Beyond that, our gear trains were identical, just perpendicular to each other. The original gear train has a connector rod that attaches to the middle casing; since the adjacent gear train didn't have the plastic piece to attach to, we lengthened the right end of the middle box vertically to attach one rod, and the other rod is attached to the upper casing. We increased the size of the casing to accommodate the second gear train and removed the cylindrical extension at the top of the box in order to account for the height of the adjacent gear train. The design of our gears stayed consistent with the original design in that the further the gear is from the connector gear, the greater the depth and the larger the teeth. In terms of rod design, we also kept this similar to the original design. The rod is designed predominantly to keep the gears in place within the train, so the type IV fit allows for a strong foundation.

We see our design as useful in many ways, but the greatest advantage of our redesign is that we're able to control perpendicular objects with a single motor. For example, in manufacturing plants, our servo could start two conveyer belts at once rather than one. This simplifies programming and increases space efficiency within the plant. We also believe this could be useful in robotics because the perpendicular motion can provide rotational motion to a part. For example, our part could be used to receive an object from a dispenser and drop it into a bin a distance away. Overall, our dual arm micro-servo is small, lightweight, and just as efficient and as a single arm servo, with many useful applications that could be applied anywhere from hobby to industry..