Robotic Arm Project

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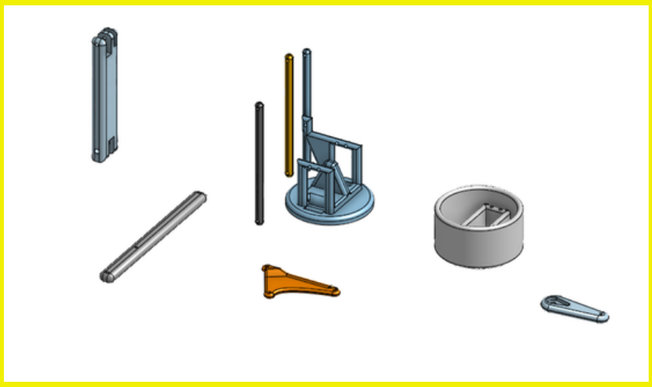
PROJECT OVERVIEW

The Robotic Arm concept stemmed from the idea of creating an Iron Man type of arm that could be mounted on a person. We initially began development with this goal in mind until we realized that there was no way that we could make what we wanted within the 200 gram filament limit. So we quickly shifted gears to this more practical and flexible concept. We realized that we wanted an arm that could pick up small objects and sort them via user input, or a color sensor. We began to work on the design of the arm by basing it on another design that we conveniently had access to thanks to Mr. Cline. We also proceeded to learn how to use the color sensor with an rgb LED to meet the human input standard and properly display the color of what the sensor was seeing. We also promptly learned how to coordinate the sticks to move the arm around in an ergonomic manner. We always kept the one hundred dollar spending limit in mind via buying the cheapest servos, color sensor, and Arduino board possible. In the end we only used blank percentage of our budget. We also worked to test our manual and autonomous code before we even had our arm functioning by running it on the kit that we were basing our design off of. Finally, we created this poster, compiled our budget spread sheet, commented our code and integrated it all into our engineering notebook. We are pleased with the fruits of our labor because our design is not only practical, but it provided a great learning experience for how to properly design parts, code unique sensors, and format it all in a clean and organized way.

ARM DESIGN PROCESS

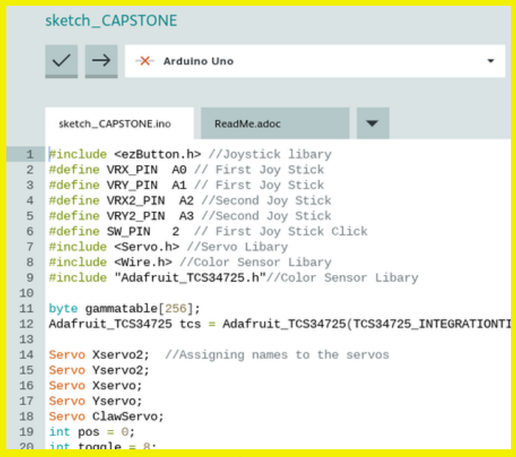
Our arm design took heavy inspiration from the EEZYbotARM mk1 made by Carlo Franciscone. We liked his design but we wanted our arm to be bigger and use the full size servos instead of micro servos. With those two goals in mind, we started to scale the arm up by a scale factor of two only to realize that the arm was not only too big considering our filament limit, but that it also was unnecessarily wide. In light of this, we changed our dimensions and printed our improved design. We quickly realized that there were several measurement errors that involved our bottom base not being centered with our top base, and our screw hole size not properly accounting for the 3d printer's slight lack of precision. On our next print we would make the hole sizes larger for the servo head mountings yet smaller in most places to fit rev screws. After the second round of design changes our prints came out and fit together properly.



(Figure 1: Picture of whole onShape Assembly)

CODING PROCESS

Our coding process was challenging in the way that it uses a color sensor and two sticks which were components of circuitry that we were unfamiliar with up until this point. Besides that minor hurdle, the rest of the code just involved servo positions that correlated to stick positions and color sensor outputs. After a short while, we had set of code for the color sensor autonomous mode where arm would move to a set position and then proceed to pick up and move an object based on its color and then it would proceed to return to its initial position where another object could be placed in front of it. We also had a separate set of code for our manual control mode where the arm can be maneuvered via two thumb sticks. Then all that we needed to do was add an LED and a switch to integrate the two pieces of code and meet all standards of physical elements.



(Figure 2: Picture of code in Arduino IDE)

ASSEMBLY PROCESS

Our assembly Process was rather simple once we had all of the components. First we had to plug in our design via a breadboard and a copious amount of wires. This was rather repetitive considering that each of the two thumb sticks used six wires, each of the four servos (including one micro servo) used three wires, the color sensor used four wires, the LED used two, and the switch used three. We also opted to use a mini bread board to make all of this wiring compact. Then we had to construct the arm and do fine tuning to ensure that our arm was rotating to the correct positions. (This was important considering the fact that we used the previously mentioned kit arm from Carlo Franciscone to test our code before the arm was complete.) This was pretty straight forward because it just involved tweaking servo positions until the arm went exactly where we wanted it to. Finally, we just needed to wrap up the little things (such as this poster) and try to make our design as presentable as possible.

(Figure 3: Picture of Finalized Arm)