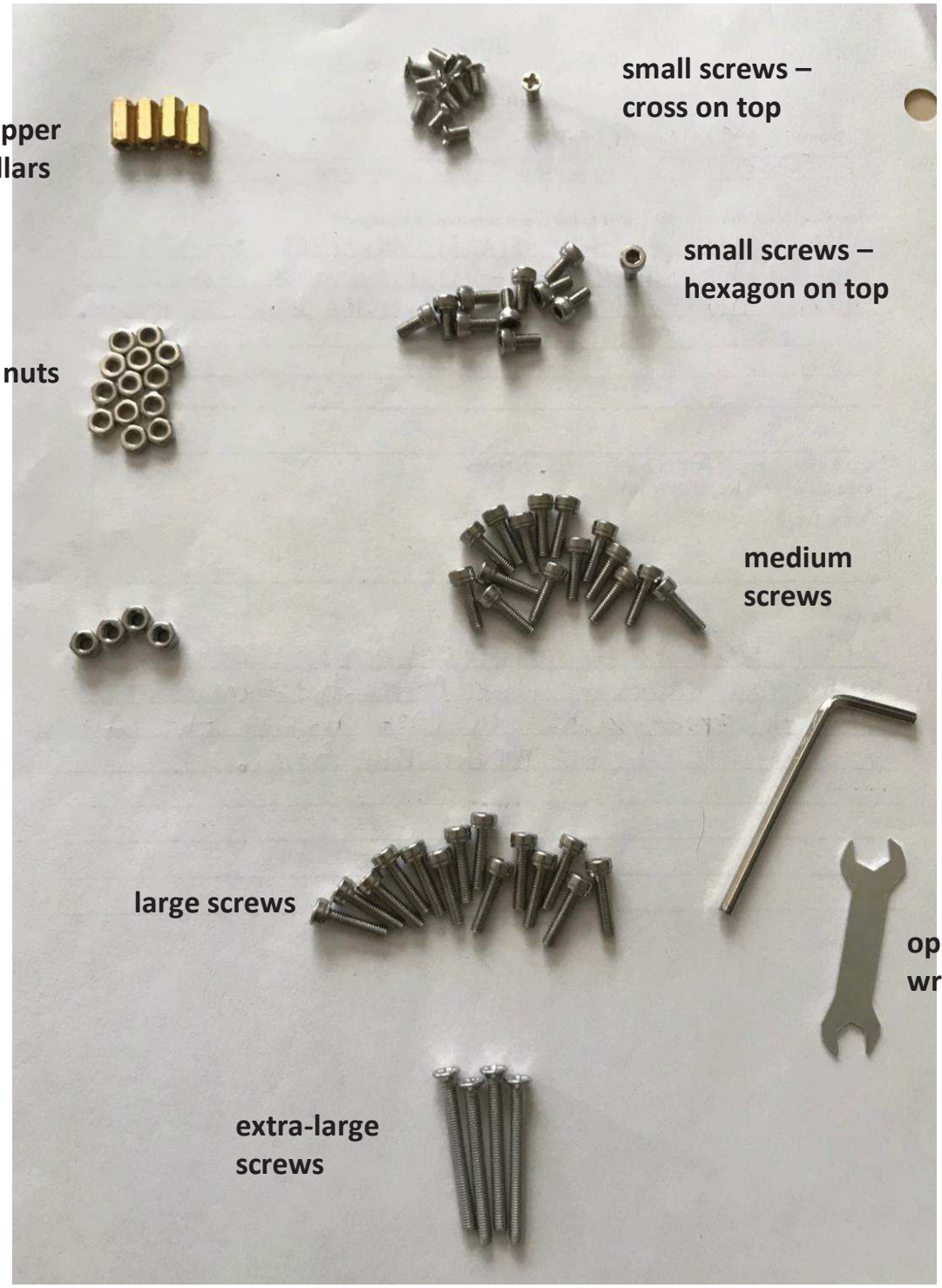
Screws Etc.



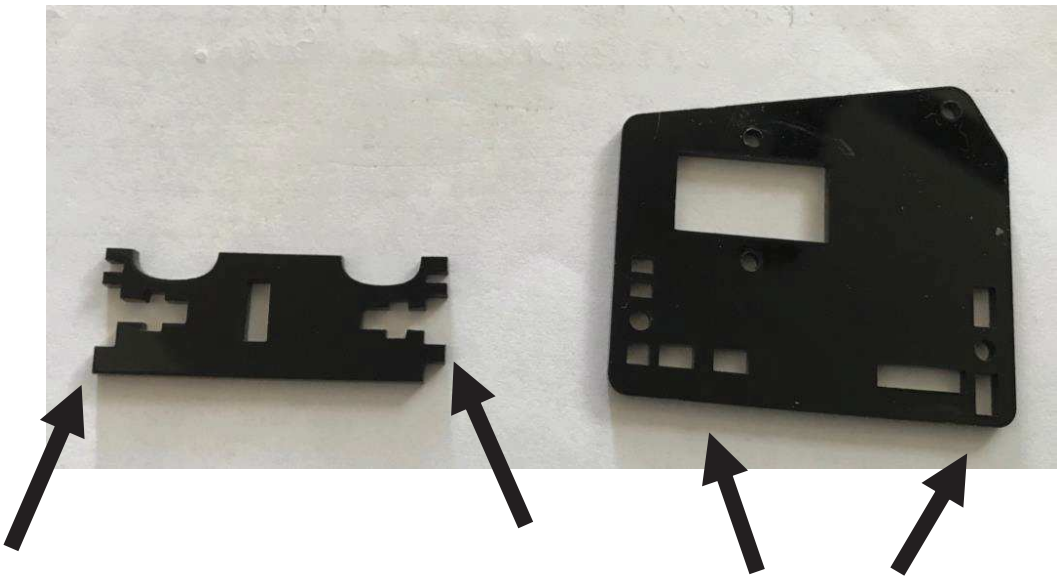
Note: There is not much difference in size between the medium screws and the large screws.

Before you use each piece of the robotic arm, take of the protective film. Take it off each side of the piece.

Tricky Skills for the Robotic Arm

Skill A: This method is sometimes used to make 3-D objects out of the flat pieces.

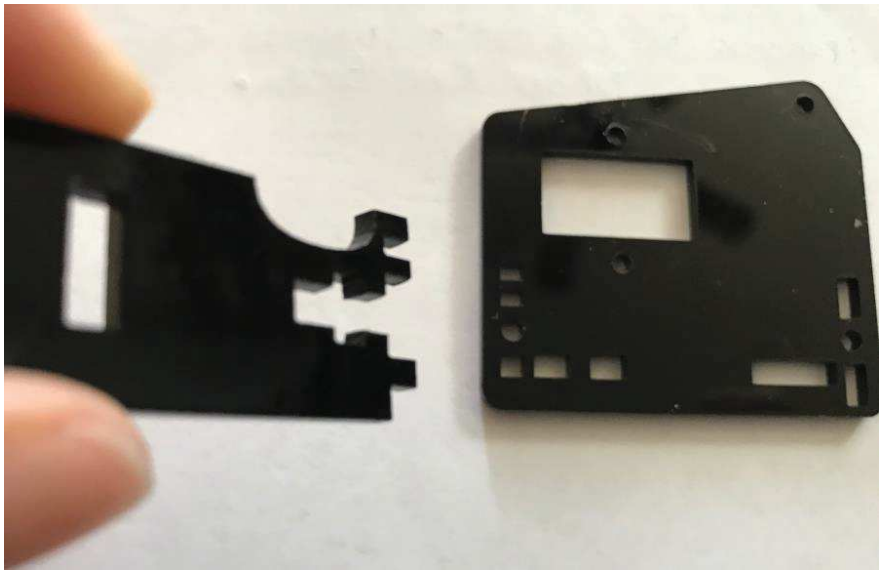
1. Find these two pieces. Notice details about how they look.



The bump is lower on the left than on the right.

There are more holes on the left than on the right.

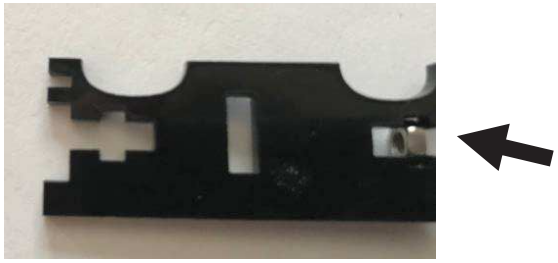
2. Get ready to put the two pieces together. Make sure you are using the side where the bump is higher up and the side with more holes.



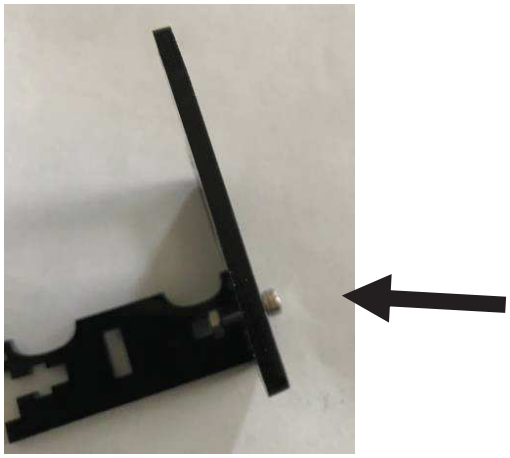
3. Slot the two pieces together. Now, you can stand this thing up so it looks like a building with two walls.

4. Find a medium screw and a flat nut.

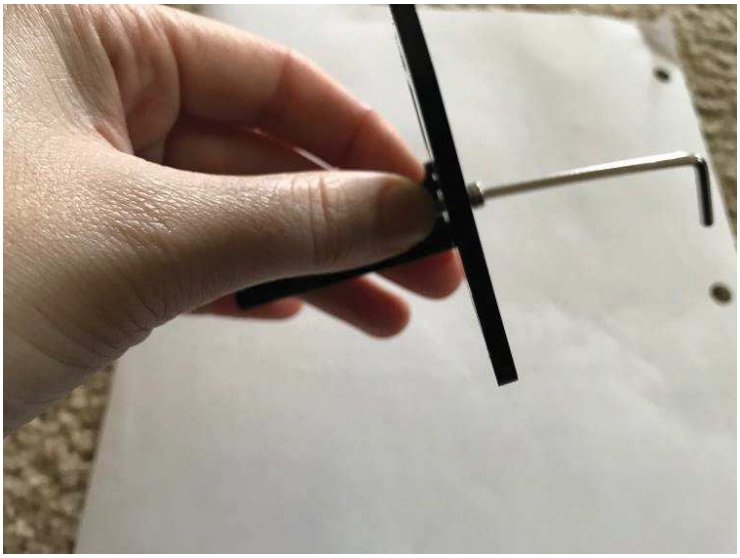
5. Slide the nut into the little space.



6. Slide the screw through the hole in the plastic and through the nut.



7. Use the Allen wrench to tighten the screw.



8. Great job! Now you have a sturdy, 3-D object. Take it apart, but don’t forget what you learned!

Skill B: This method is sometimes used to join pieces of plastic.

1. Find these two plastic pieces and a medium screw.

2. Try putting the screw through each hole in the plastic. Notice that on the long piece of plastic, it goes through each hole easily. On the other piece of plastic, it goes through one of the holes easily. It would have to be screwed into the other two holes.

3. Put the screw through one of the holes in the long piece of plastic.

4. Use the Allen wrench to screw it into this hole in the other piece of plastic.



5. Notice that the two pieces of plastic stick together because you put the screw through the big whole first, then the small hole.

6. Now, take this apart.

7. We will try doing this wrong. First, use the Allen wrench to screw the screw into the funny-shaped piece of plastic.

8. Put the screw through the hole in the long piece of plastic.

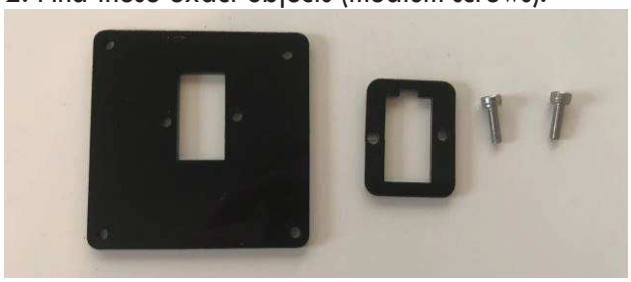
9. Notice that this does not hold the two pieces of plastic together. When you are making your robot arm, if things are not sticking together, it might be because you put a screw through a small hole before a big hole.

10. Take this apart, but don’t forget what you learned!

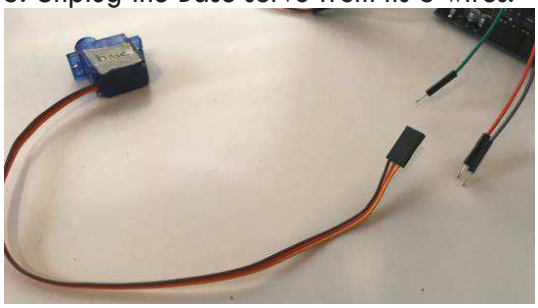
Build Your Robotic Arm! (Part 1)

1. Stick the 4 extra-large screws up through the largest piece of plastic around the diamond. Use 4 nuts to connect them. Tighten with a screwdriver.

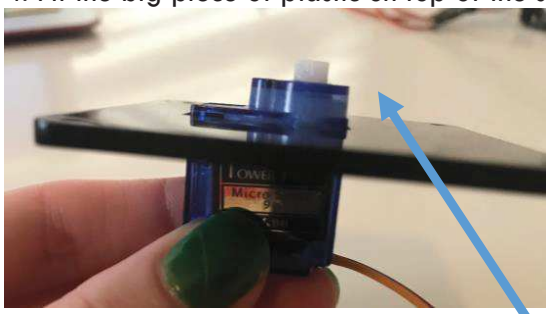
2. Find these exact objects (medium screws):



3. Unplug the Base servo from its 3 wires.

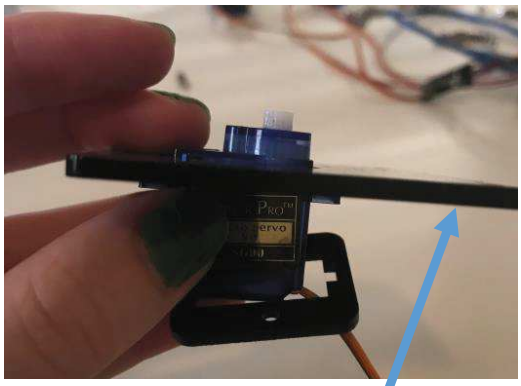


4. Fit the big piece of plastic on top of the servo.



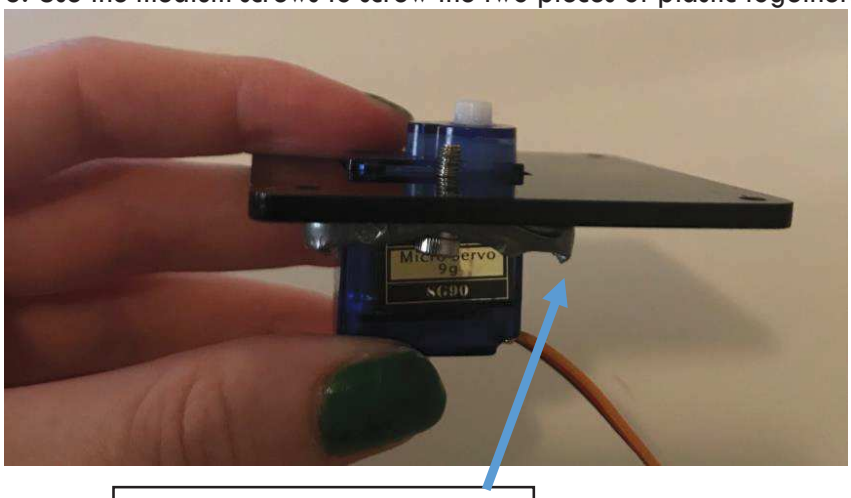
The sticking-up part faces the longer side of the black plastic thing.

5. Fit the other plastic thing underneath the servo motor.



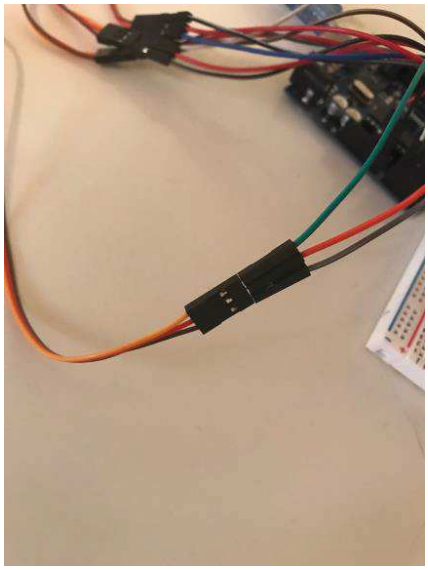
The part of the hole that sticks out faces towards the wire.

6. Use the medium screws to screw the two pieces of plastic together. Don't screw these super tight!

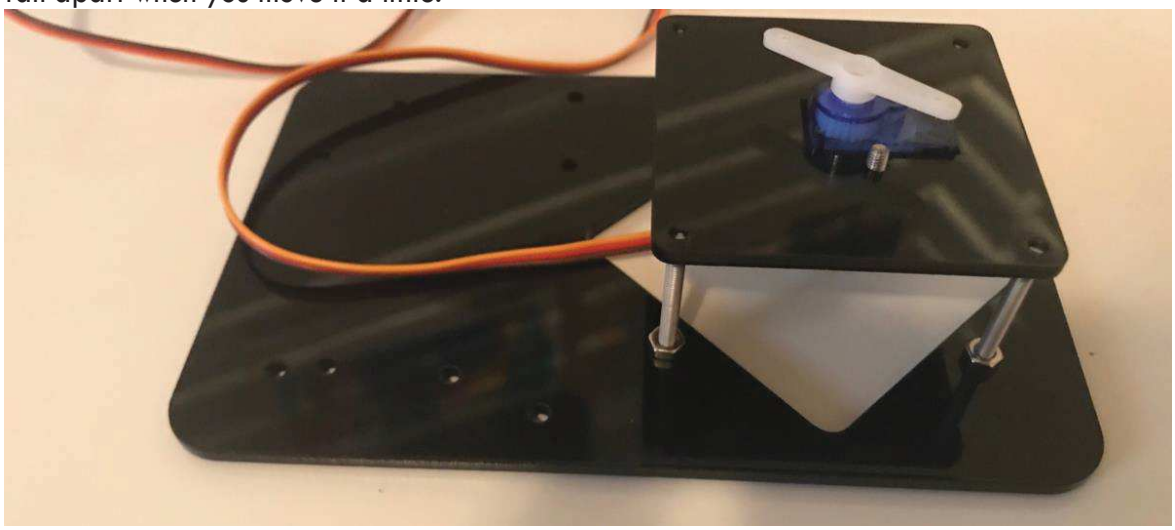


Put the screws in the bottom.

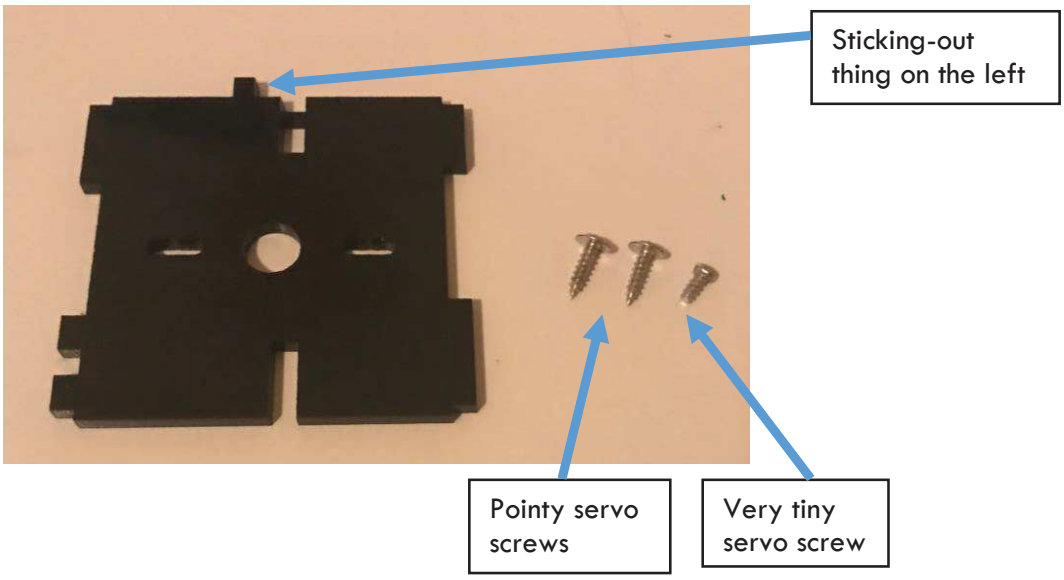
7. Reconnect the servo wires. Make sure your Arduino is plugged into a computer, and then check that the servo motor still turns when you turn the potentiometer.



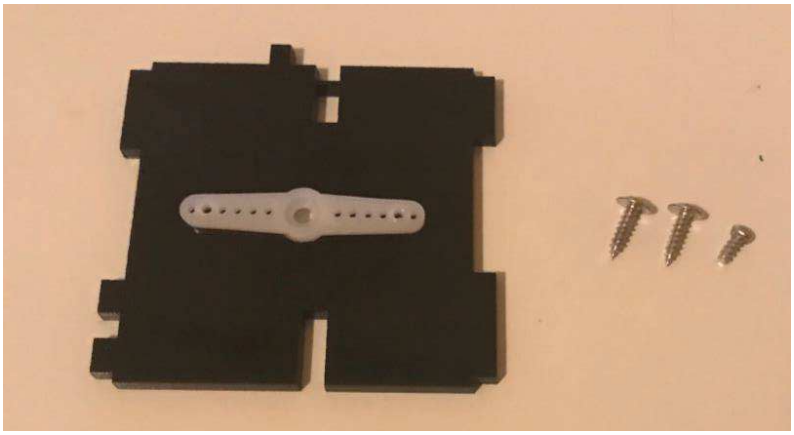
8. Fit the part you just made on top of the base plate. Make sure it is facing the right way. The wire should be sticking out along the base plate. You should be able to see that all four metal screws are in the holes. It should not fall apart when you move it a little.



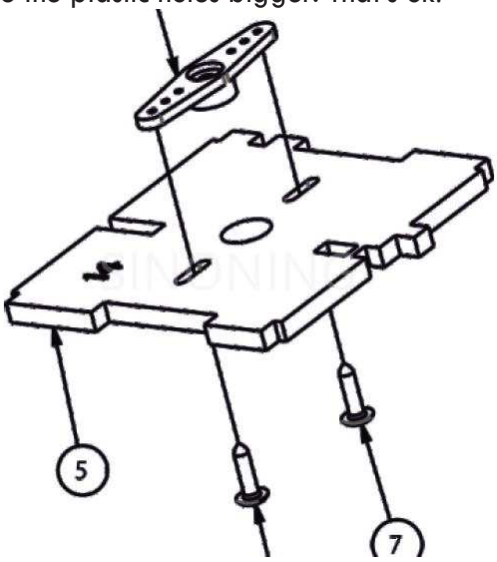
9. Find these objects. Line up the black thing exactly like this.



10. Put the white thing on top. Make sure it is still lined up like this, with the sticking-out thing on the left.



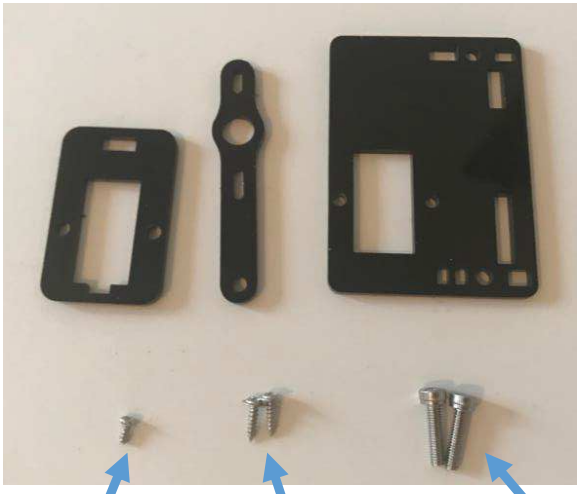
11. Take the white plastic thing off the base servo and attach it to this black piece of plastic. The pointy screws will make the plastic holes bigger. That's ok!



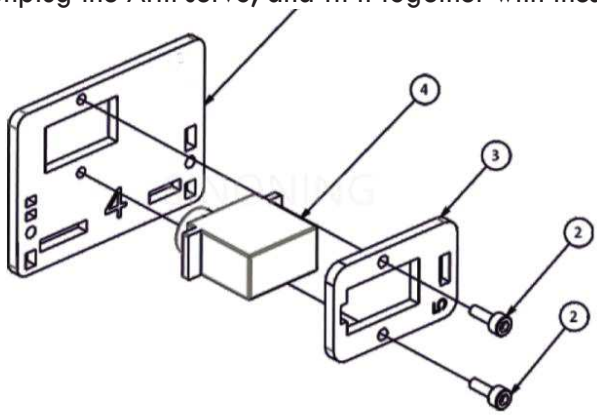
12. Use the very tiny screw to attach this black piece of plastic to your base. Make sure it is facing the right way!

13. Plug your Arduino board into a computer and make sure your base servo still works.

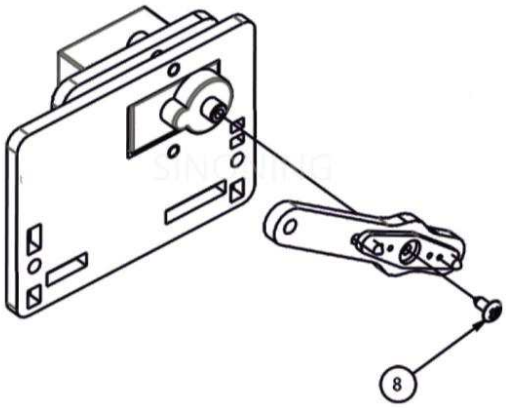
14. Find these exact objects:



15. Unplug the Arm servo, and fit it together with these objects.

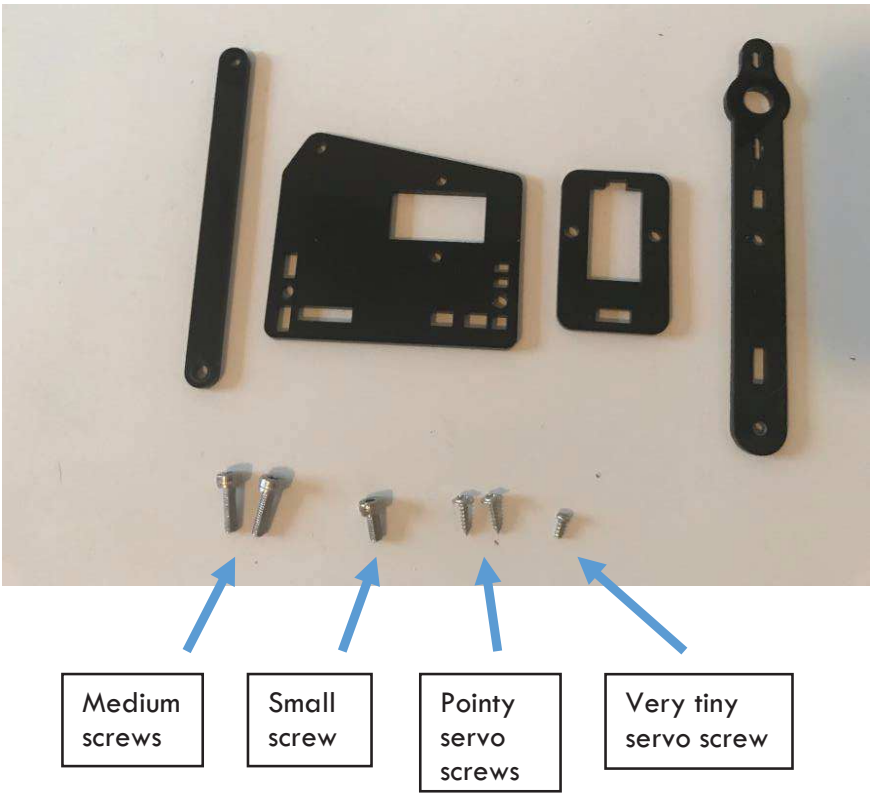


16. Attach these parts:

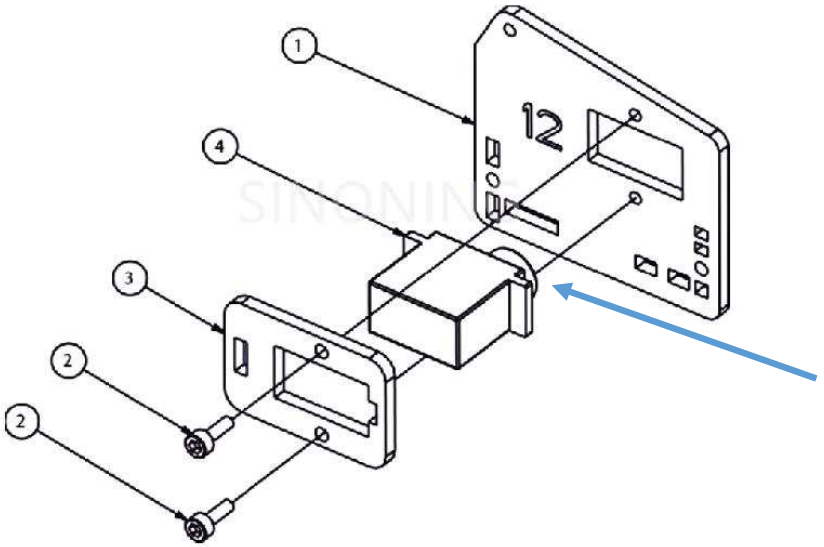


17. Plug the servo back in, and check that it still works. Then, set that part aside. You will use it later.

18. Find these exact objects:

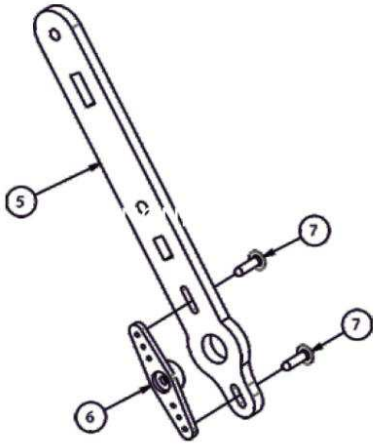


19. Unplug the Wrist servo, and fit it together with these objects.

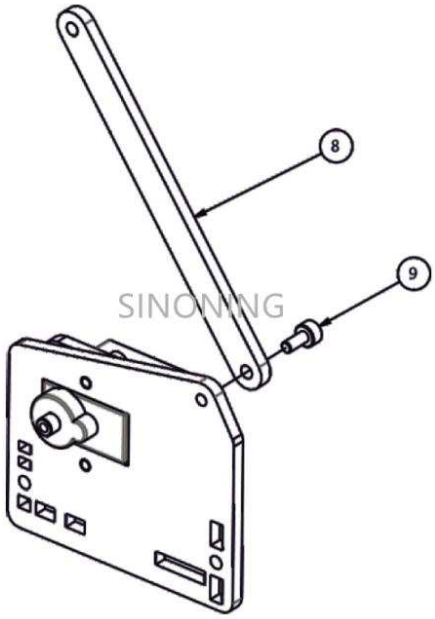


The sticking-up part of this is towards the right.

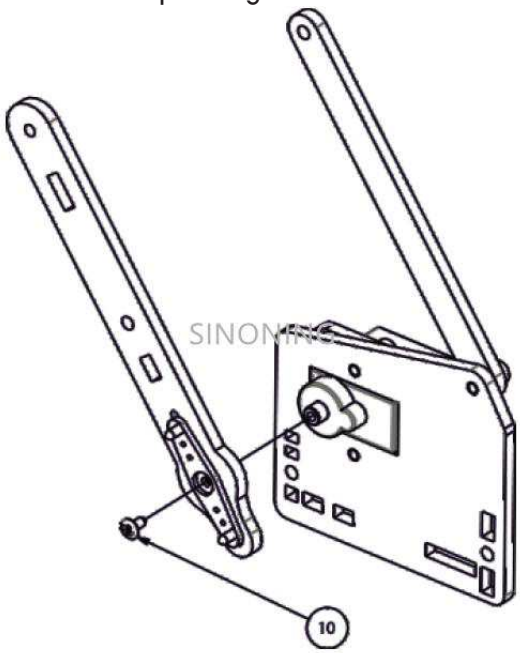
20. Fit these objects together:



21. Fit these objects together:

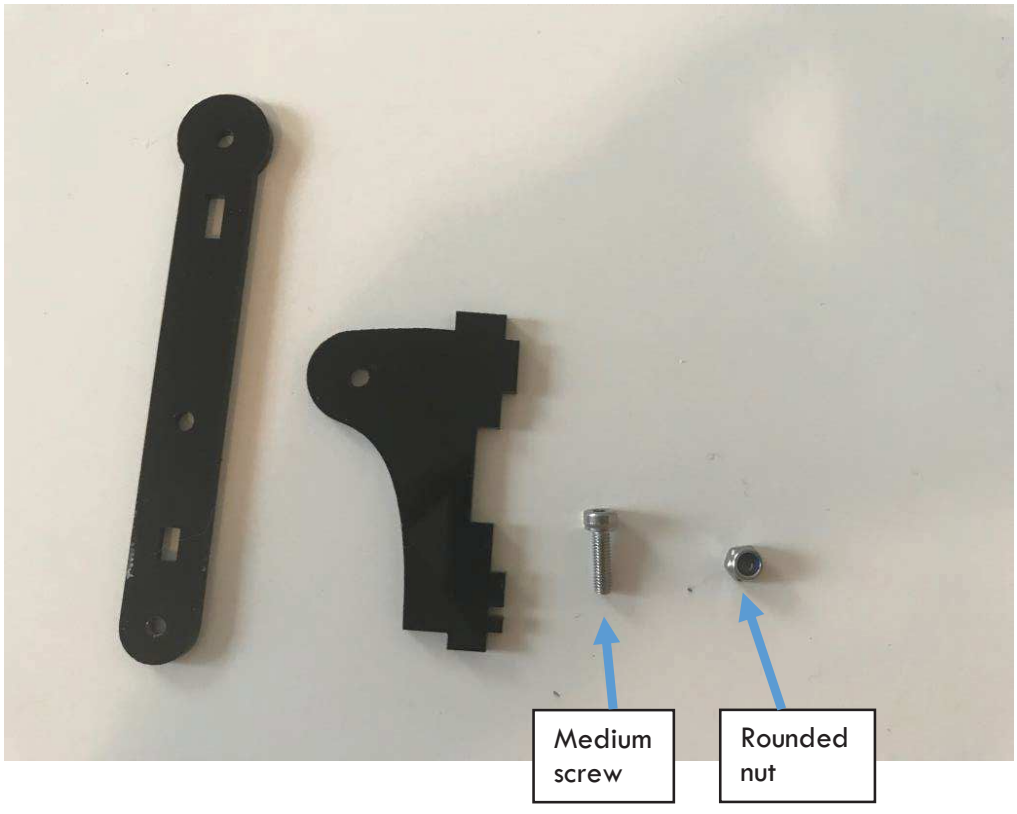


22. Fit these objects together:



23. Plug the servo back in and check that it still works. Put this part aside. You will use it later.

24. Find these objects:

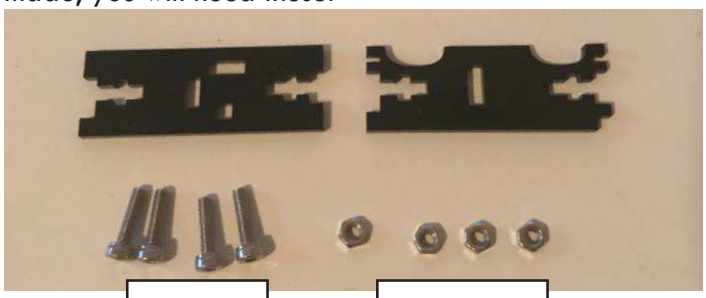


25. Fit them together like this:

Front

Back

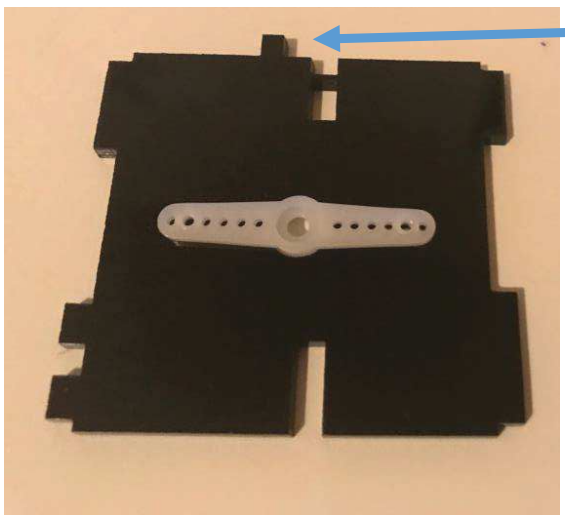
26. Now we are going to use a skill you practiced earlier to make a 3-D object! In addition to the things you already made, you will need these:



Large screws

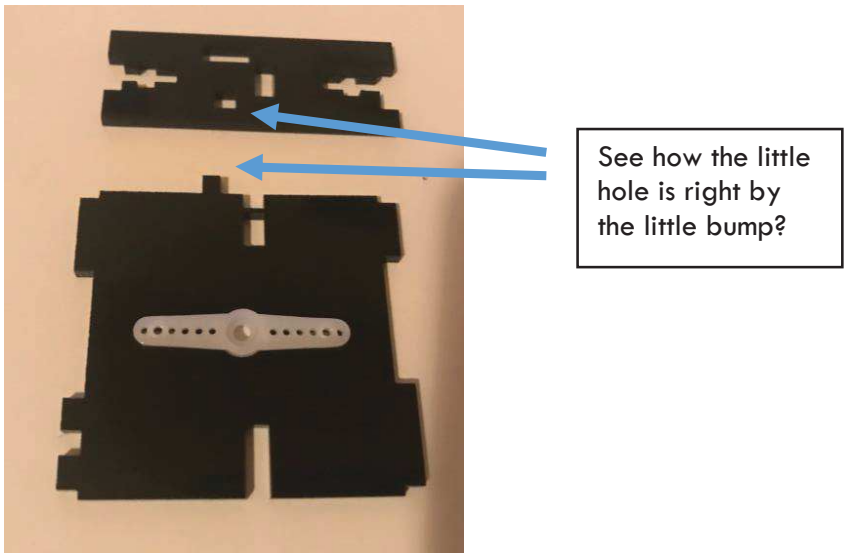
Flat nuts

27. Unscrew the tiny servo screw and remove this piece from the base. Put it on the desk exactly like this.

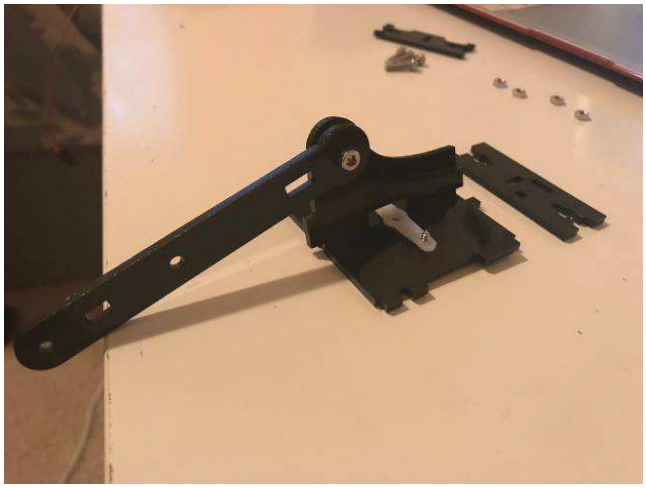


Sticking-out part points away from you.

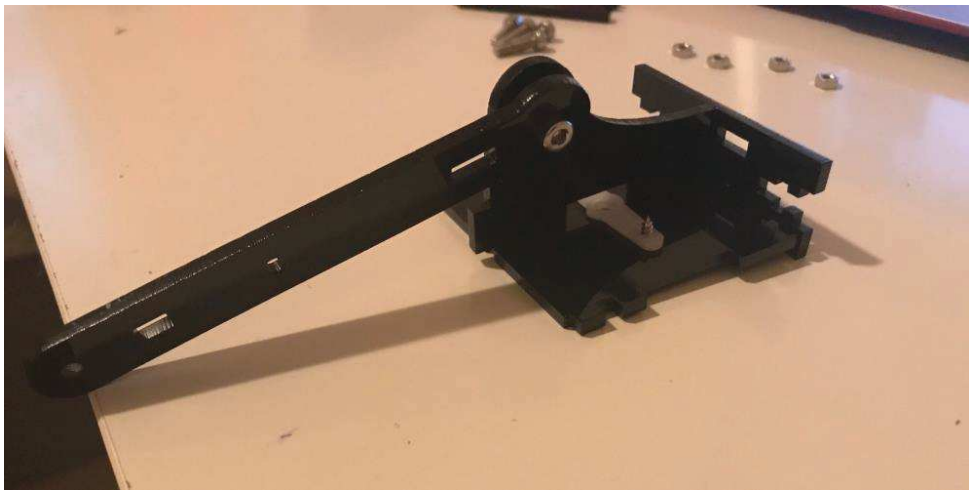
28. Put this piece on the desk right above it. Make sure you put it down exactly like this.



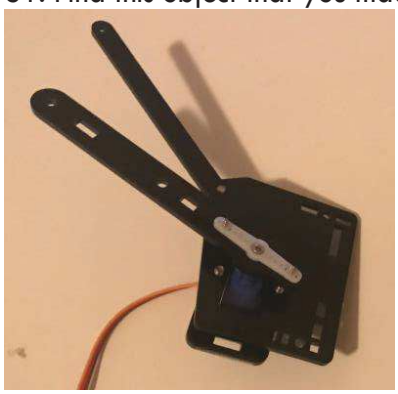
29. Fit this other piece together with the larger piece. If you line them up right, they fit into each other and they will stand up on their own.



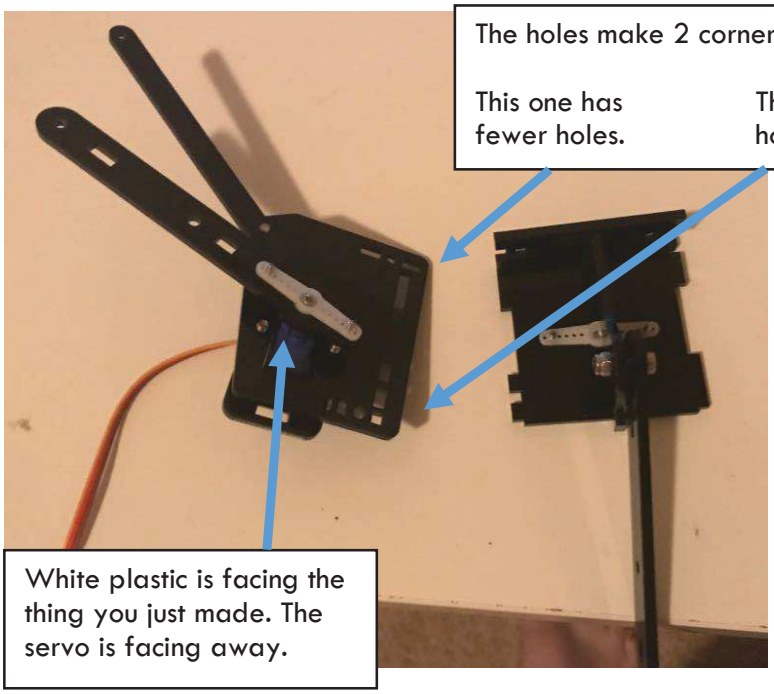
30. Flip up the smaller piece to make the back of the object. Again, if you line these things up right, they will fit into each other, and it will stand up on its own.



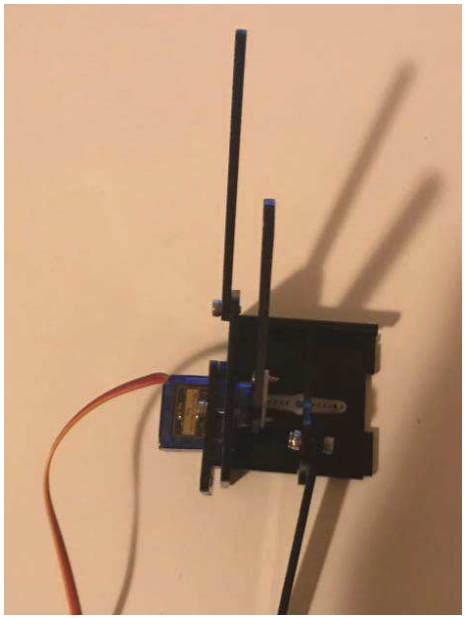
31. Find this object that you made. Unplug the servo motor.



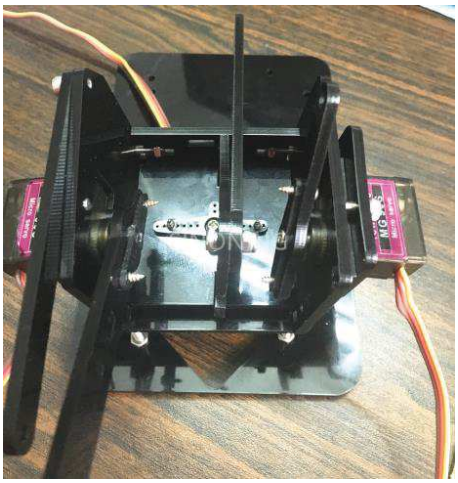
32. Put this on the left of the piece you were working on. Line it up just like this.



33. Flip this new piece up so that it becomes the left side of your 3-D object. Parts of the other pieces will fit into those L-shaped holes.

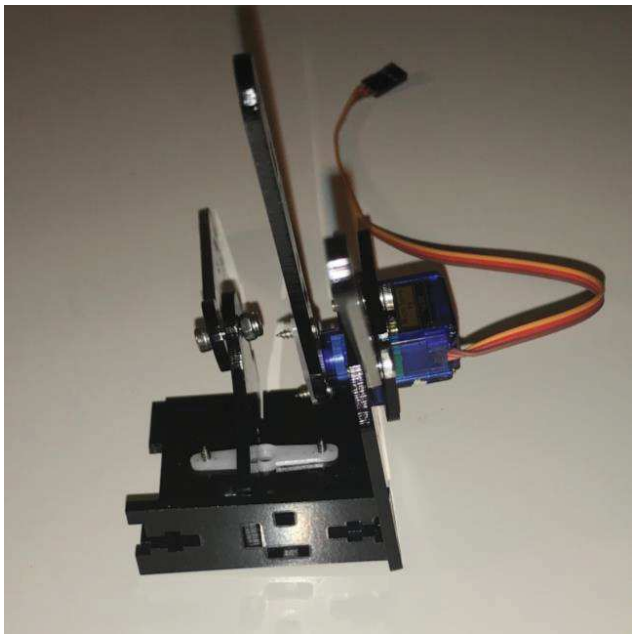


Here's another picture in case that helps. We haven't made the right side of this yet.

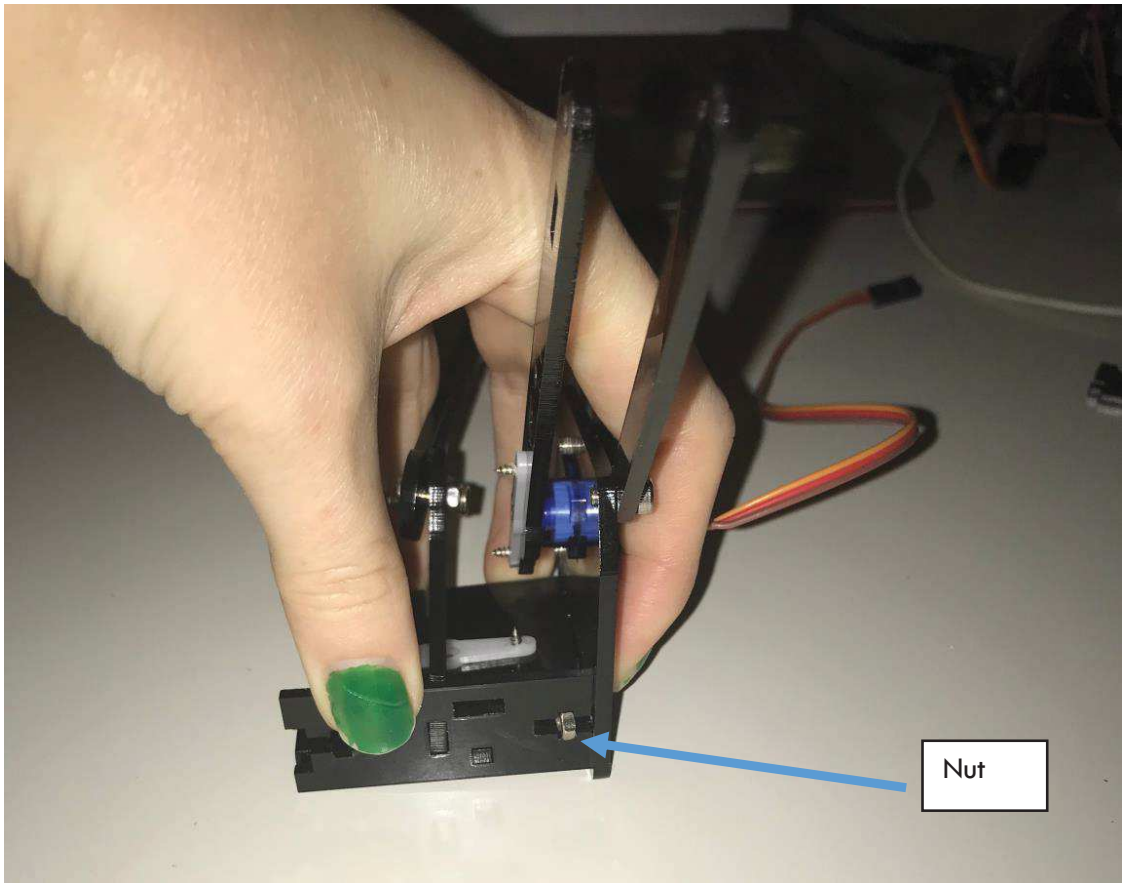


Build Your Robotic Arm! (Part 2)

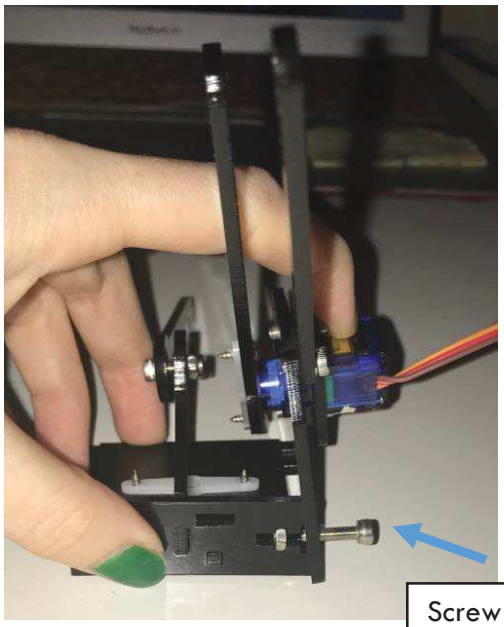
34. Turn this around so you are looking at the back.



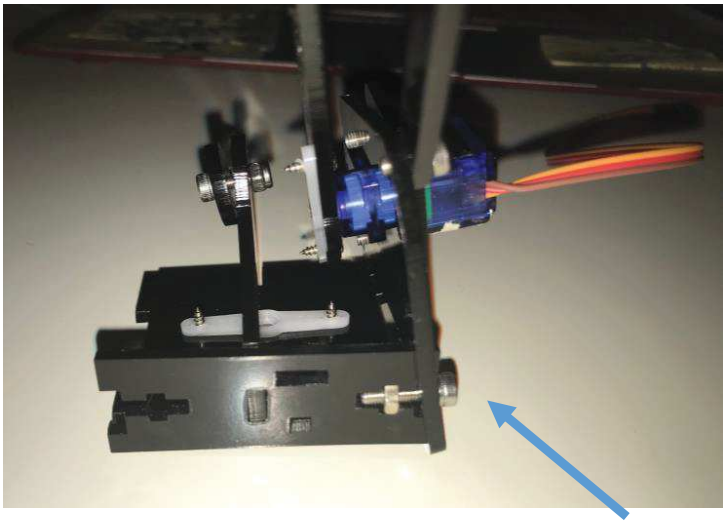
35. Hold this in place while you put a nut in this little hole. I know this is tough! If it falls apart, we can put it back together.



36. Put a screw in the hole at the side. Use the Allen wrench to screw it into the nut.

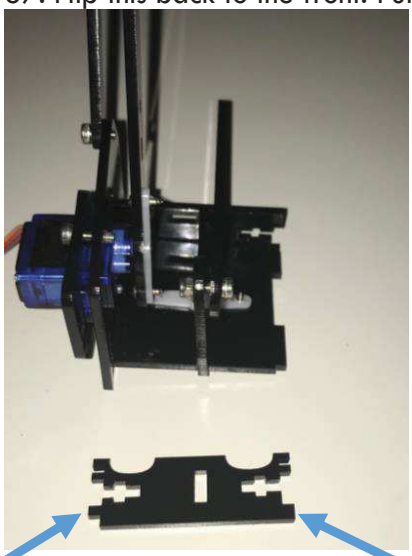


Screw



Tightened

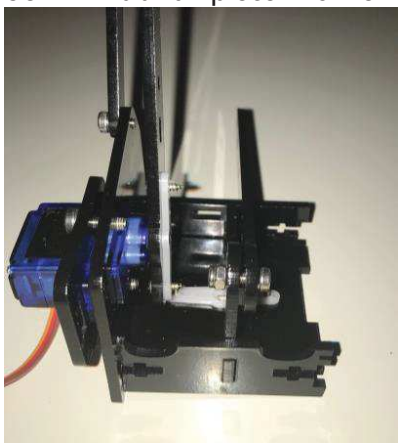
37. Flip this back to the front. Put this smaller piece of plastic by it just like this.



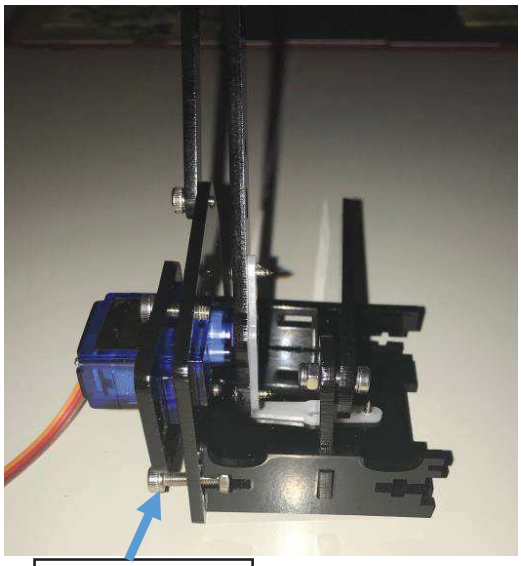
Sticking-out piece is higher.

Sticking-out piece is lower.

38. Fit this small piece into the holes.

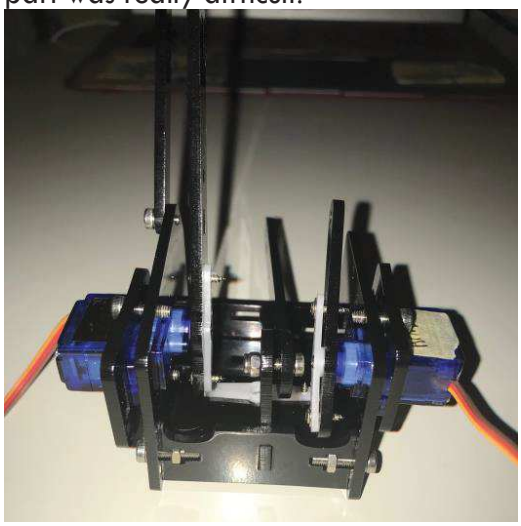


39. Use a screw and nut to connect this like you did before. Use the Allen wrench to tighten the screw.



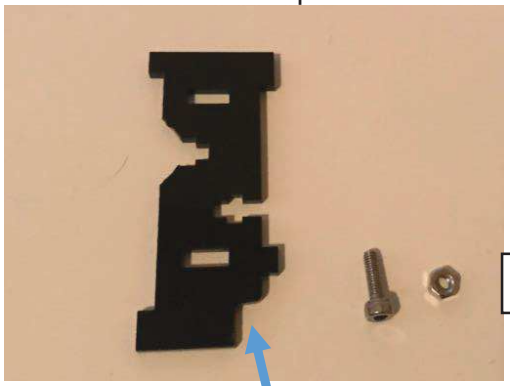
Screw and nut

40. Fit the piece with the other servo into the holes. Connect it with the other two screws and nuts. Way to go! This part was really difficult!



41. Plug the servos back in and test them to make sure they still work. It actually doesn't matter if you mix up the Arm and Wrist servos.

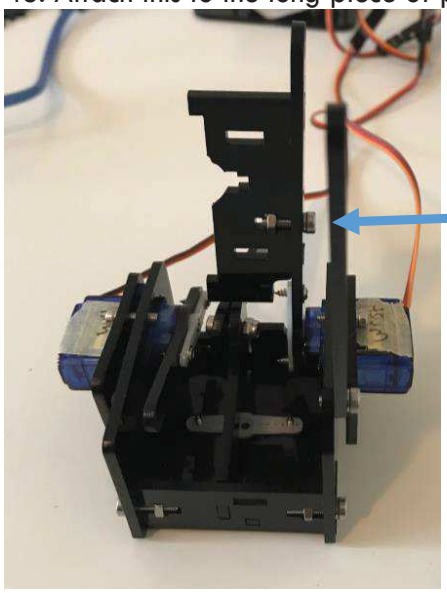
42. Find these exact objects.



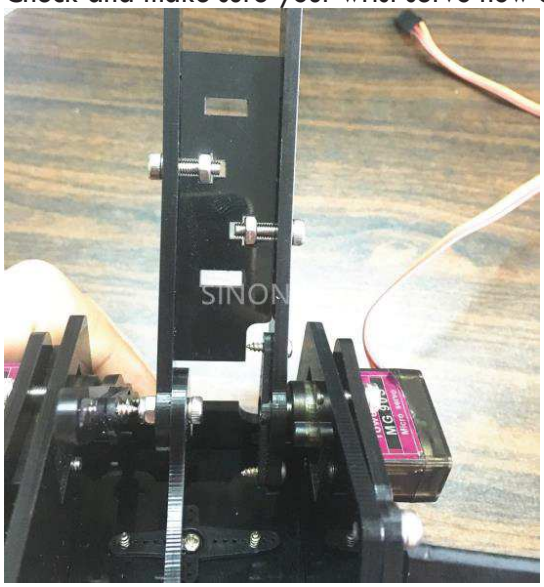
Medium screw and nut

The curved part like this: (will go on top of the white plastic thing so nothing will bump the pointy servo screws.

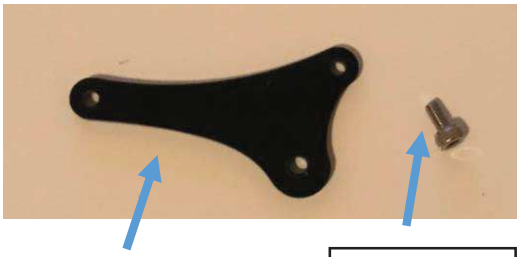
43. Attach this to the long piece of plastic that is connected to the Wrist servo. There's only one way that it fits.

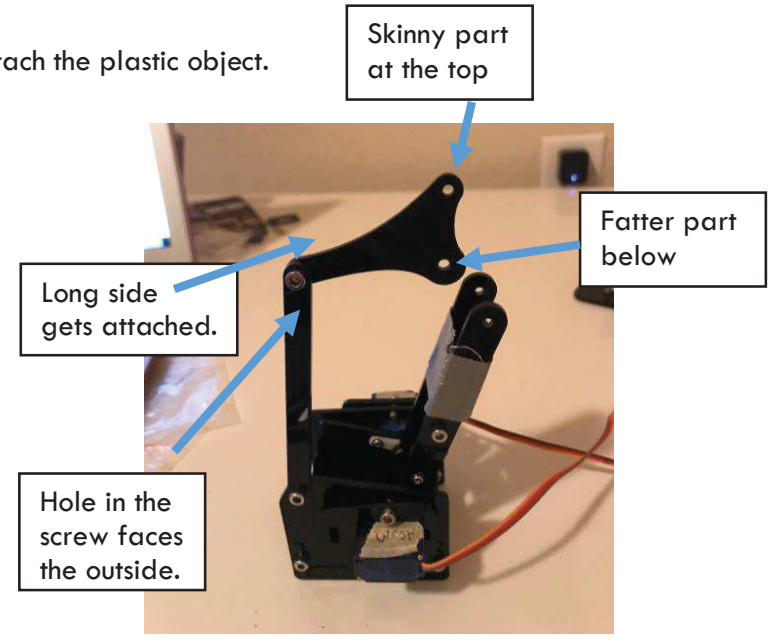


44. Use another medium screw and nut to connect the other side of the flat piece to the other long piece in the center. Check and make sure your wrist servo now controls this whole arm!

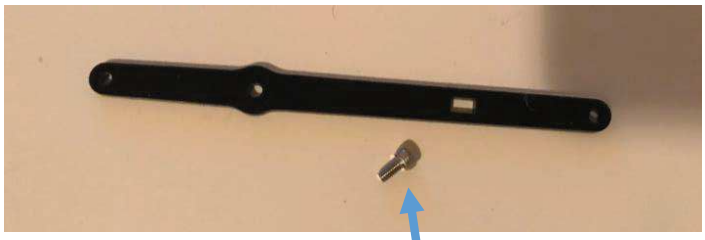


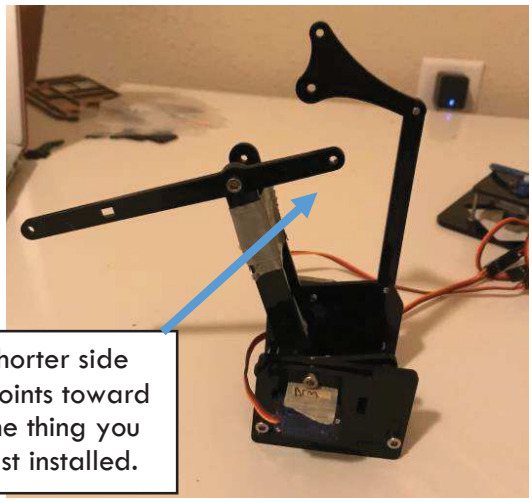
45. Find these exact objects. Use the screw to attach the plastic object.



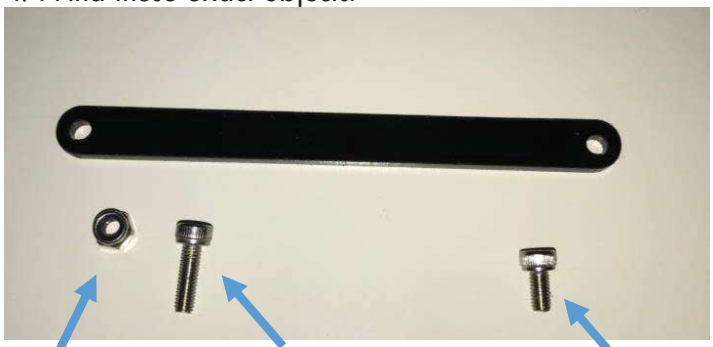


46. Find these exact objects. Flip your robotic arm around. Use the screw to attach the middle of the plastic piece to the other arm on the other side.

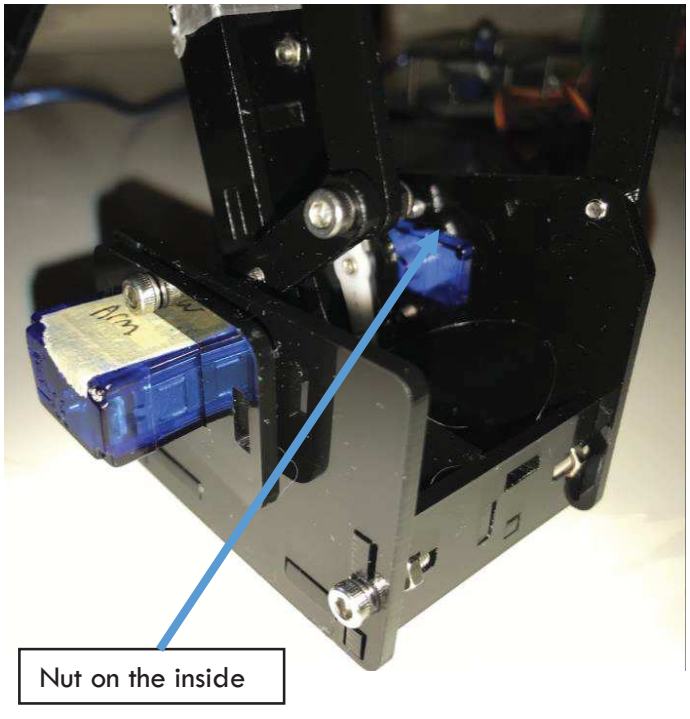




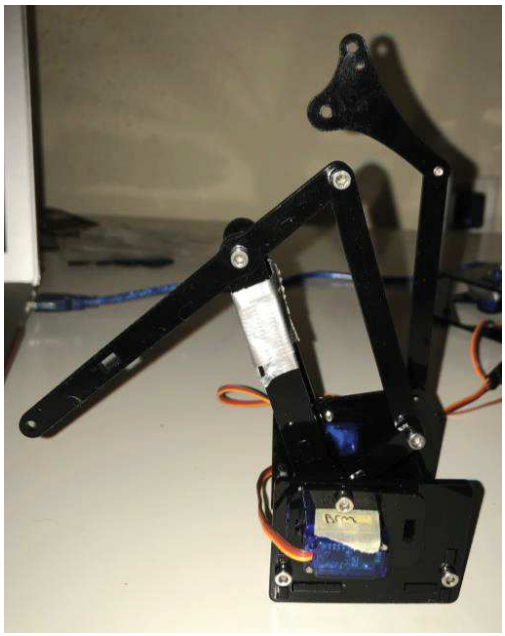
47. Find these exact objects.



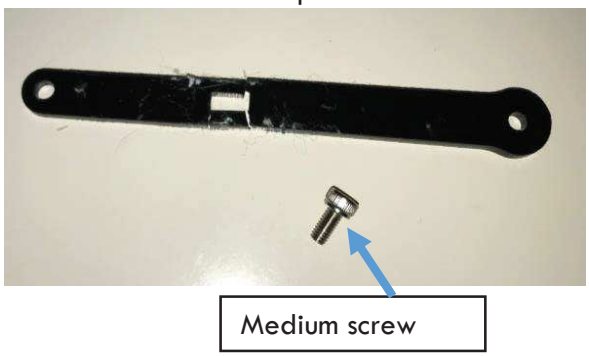
48. Use the medium screw and the nut to attach one side of the plastic piece to the piece that is connected to the Arm servo. If you need the servo to move, use the potentiometer instead of moving it with your hands.



49. Use the small screw to connect the other side of the plastic to the long piece you just installed. Test to make sure your servo can move fully. We want these screws to be pretty loose.

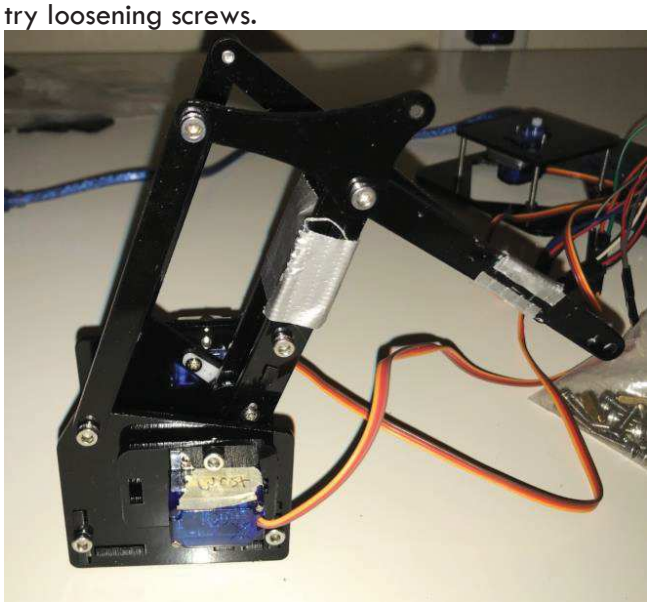


50. Find these exact objects:



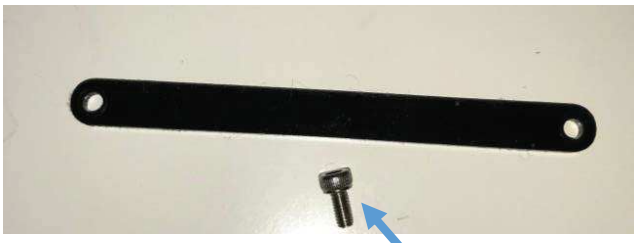
51. Attach this piece of plastic to the bottom hole on the 3-sided piece. The 3-sided piece is on the outside, this new piece is in the middle, and then the screw goes through the main arm on the inside.

Check to make sure your servos can still move completely when you twist the potentiometers. If something is buzzing, try loosening screws.

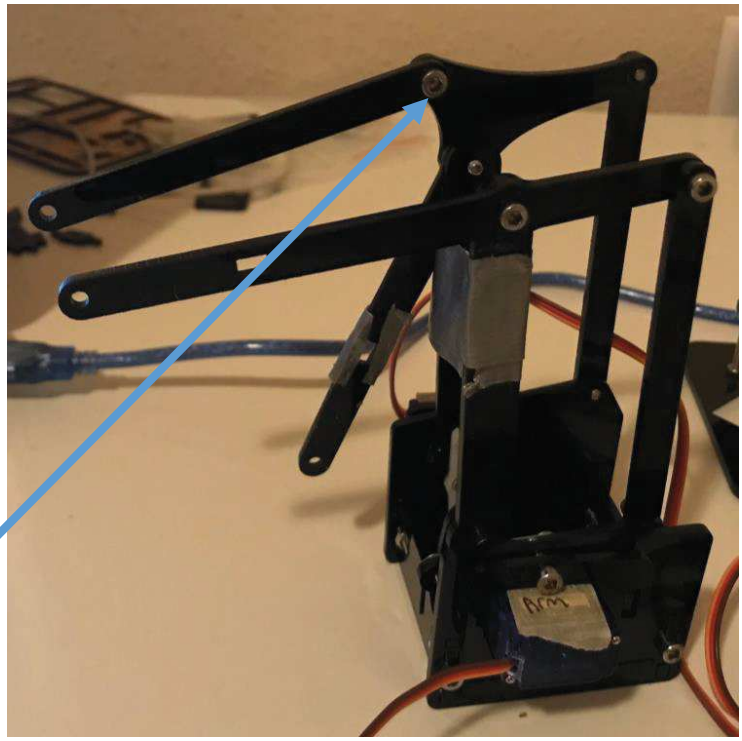


Build Your Robotic Arm! (Part 3)

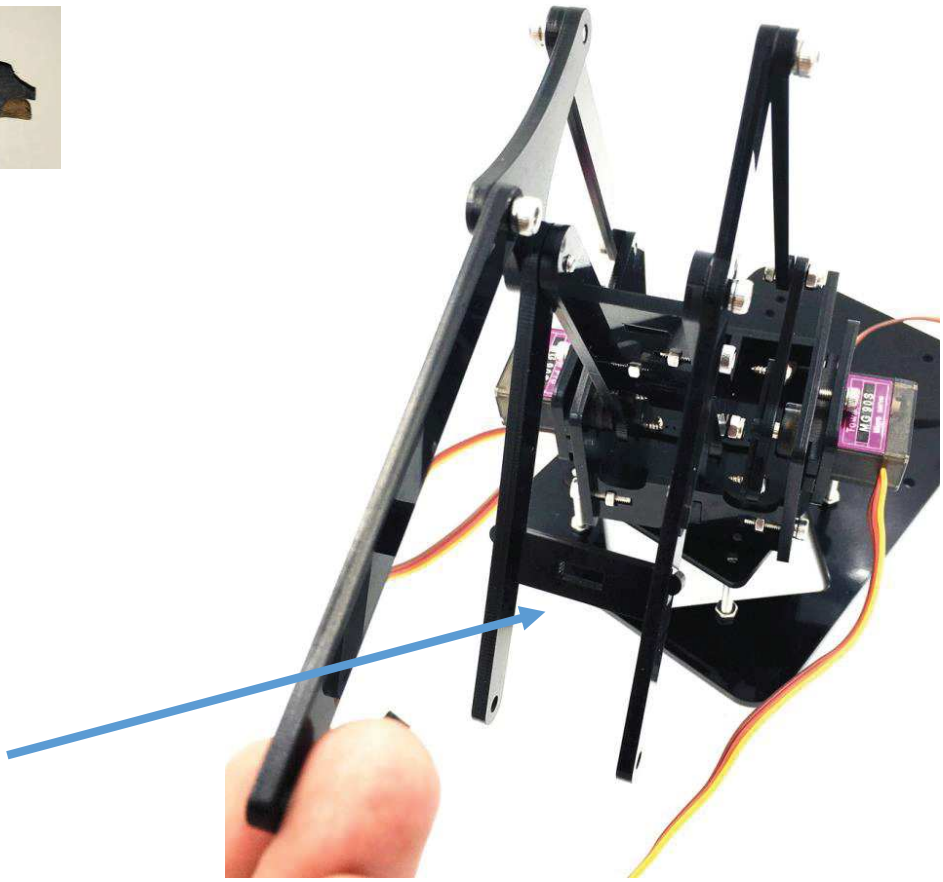
52. Find these objects. Attach the plastic piece to the top of the 3-holed piece. The hole in the screw and the new piece should be on the inside, not the outside.



Small screw

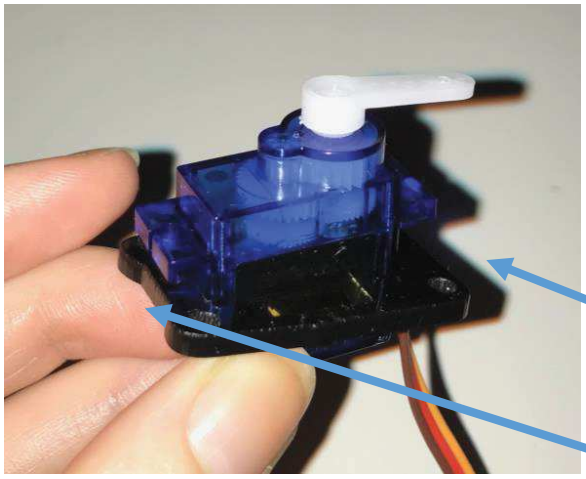


53. Find this piece. Use it to connect the two long pieces of plastic with the holes.

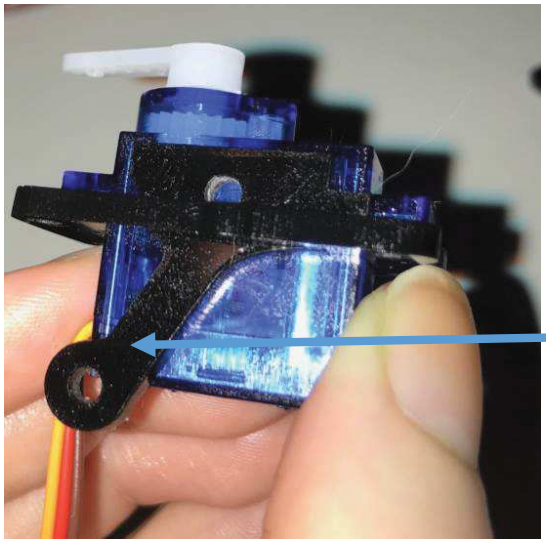


54. Unplug the Grip servo. Find these exact objects:

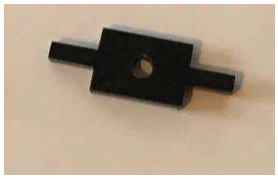
55. Put this black piece of plastic through the bottom of the servo.



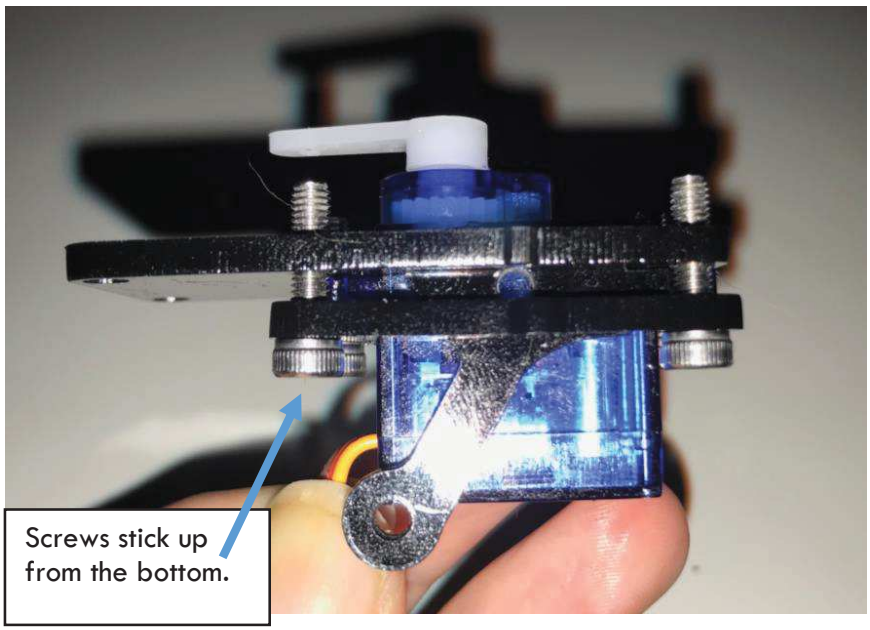
56. Put this part in the opening on the left side.



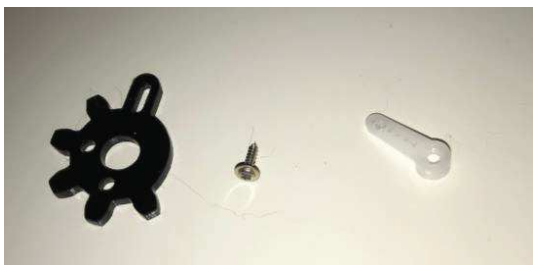
57. Put this part in the opening on the right side.



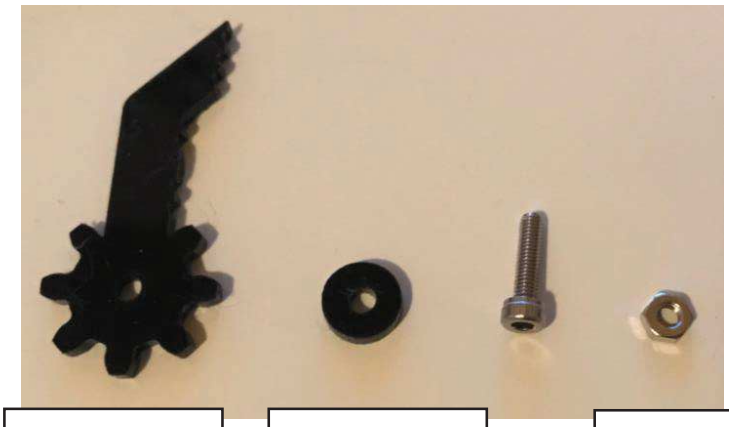
58. Put the large piece on the top. The bigger part should be facing the white blade and the wires. Use the 4 screws to hold it in place. Plug the grip servo back in and check that it still works.



59. Take the white blade off the Grip servo. Use a pointy servo screw to connect it to this object.



60. Find these exact objects.

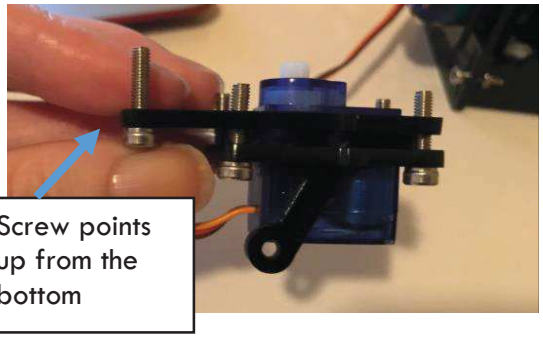


Claw with only one hole

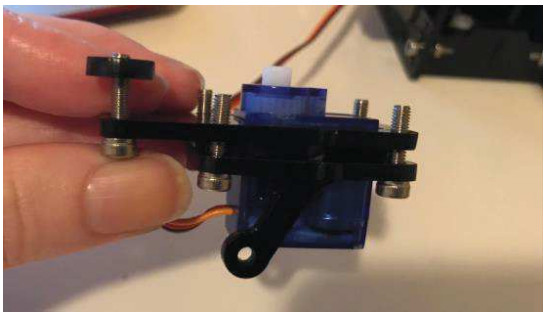
Large screw

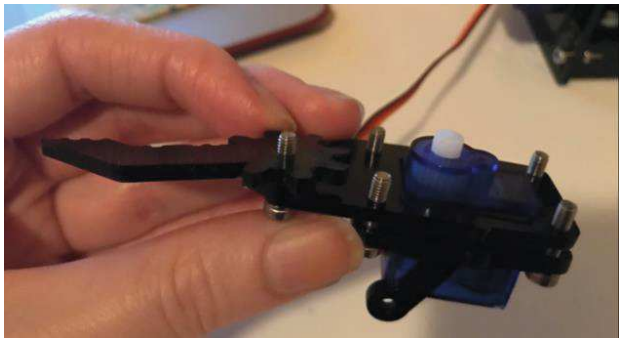
Flat nut

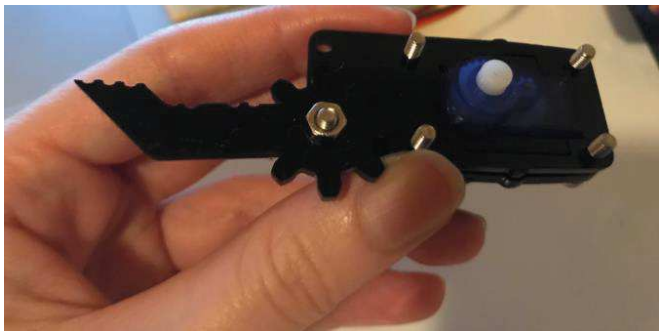
61. On the left side of the Grip servo, put in the screw, then the plastic circle, then the claw, then the flat nut. Screw it just tight enough that the claw doesn't move around.



Screw points up from the bottom





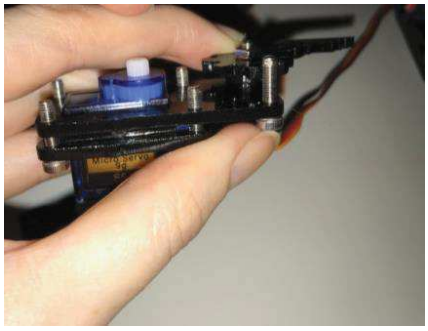


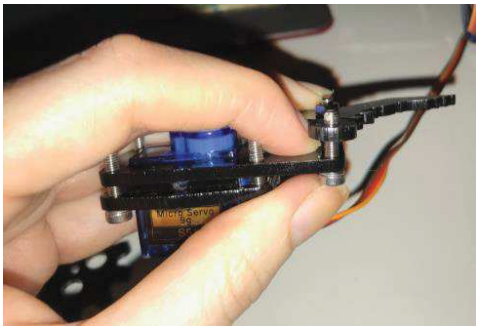
62. Find these exact objects.

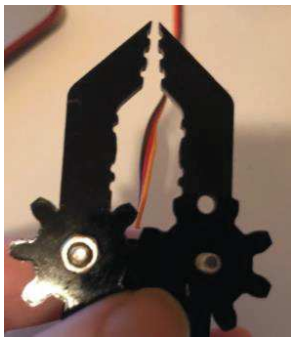
Large screw

Claw with 2 holes

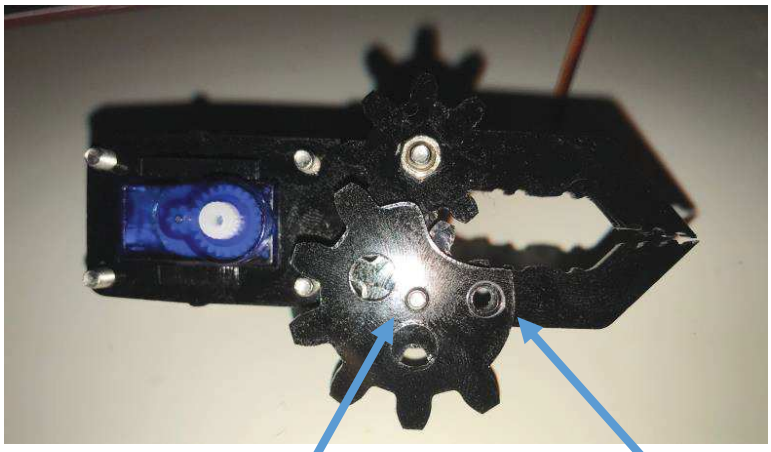
63. On the right side of your grip servo, put in the screw, then the circle, then the grip. Make the grip fit nicely with the other one grip.



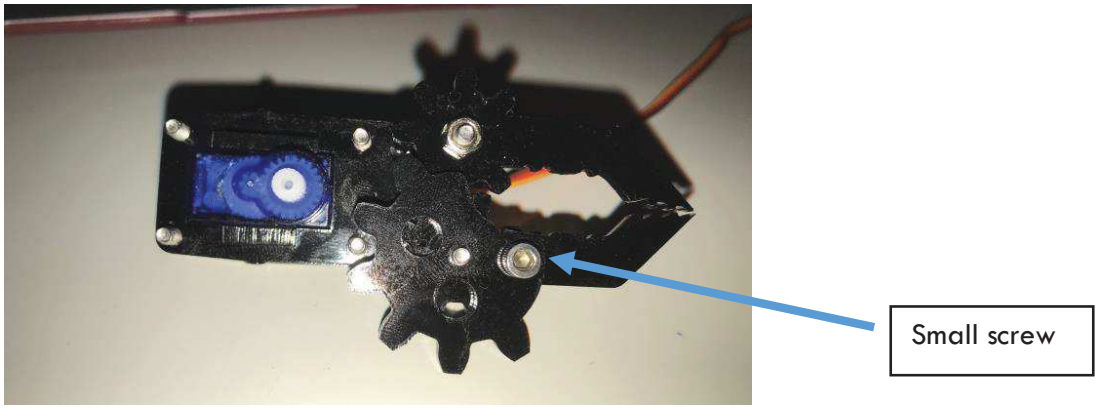




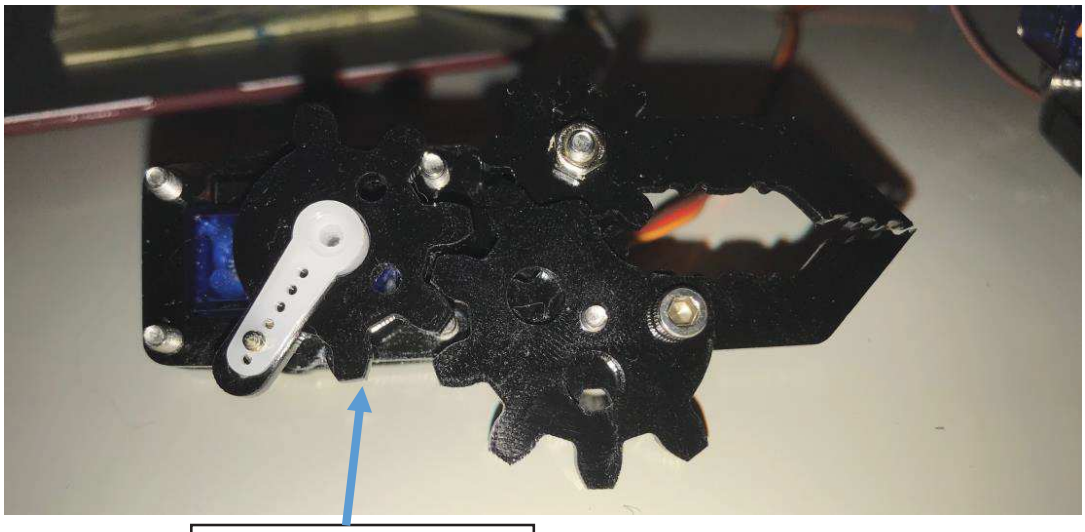
64. Add the last object that you got out. Use the Allen wrench to tighten the screw, but not super tight.



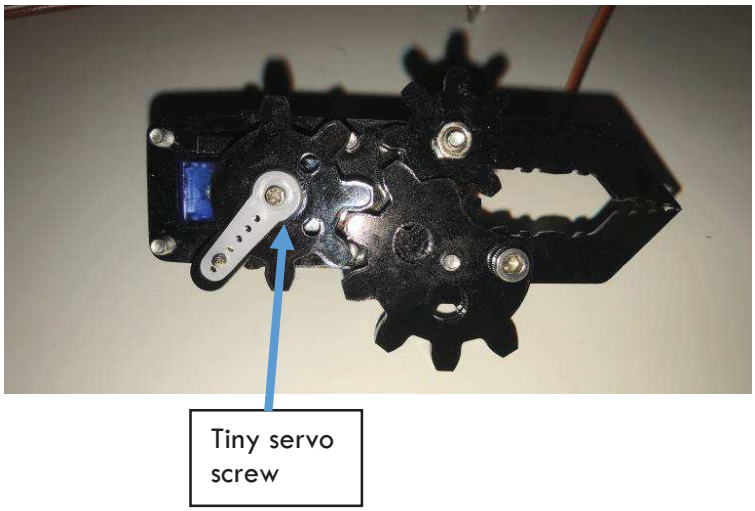
65. With a small screw, connect the two holes that you just lined up.



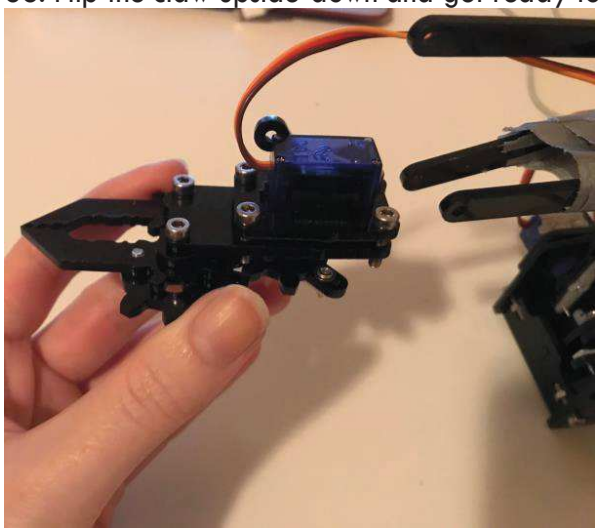
66. Snap the other piece into place like this.



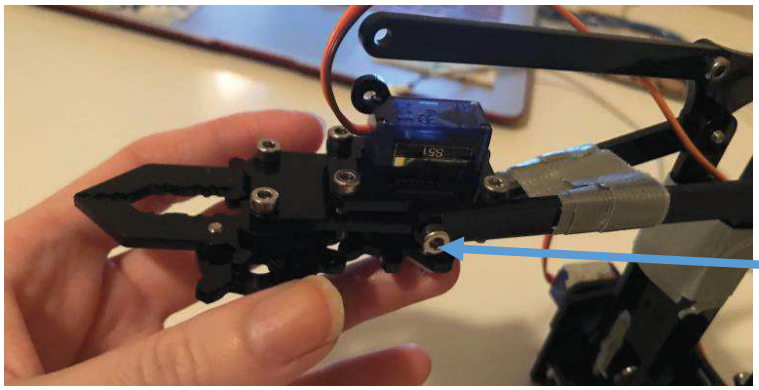
67. Use a tiny servo screw to connect the white blade. Test the servo and see if it causes the claw to open and close. If it doesn't work, things might be too tight.



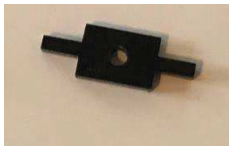
68. Flip the claw upside-down and get ready to attach it to the robotic arm.



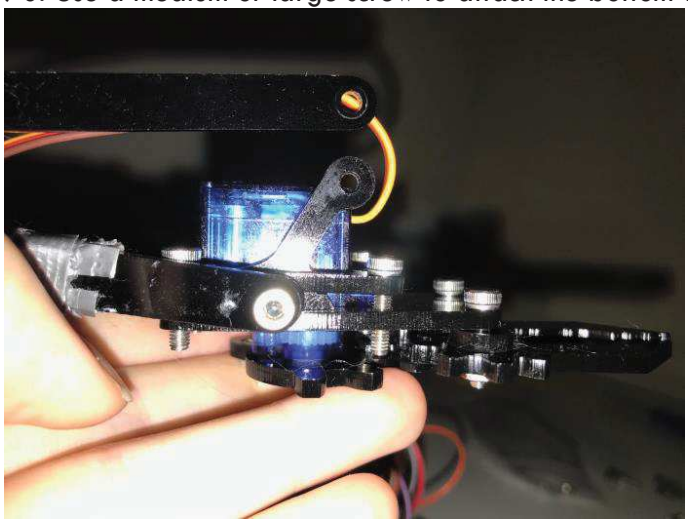
69. Use a medium or large screw to attach the left side. Do not make this very tight.



The screw needs to go into a hole in this piece. You may need to loosen other screws to make this work.

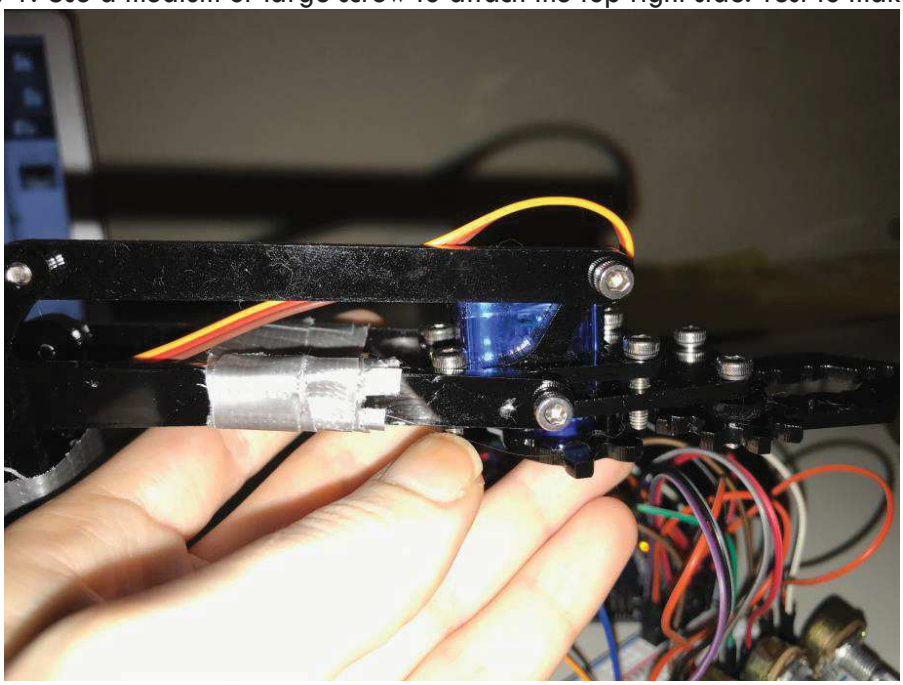


70. Use a medium or large screw to attach the bottom-right side. Do not make this very tight.

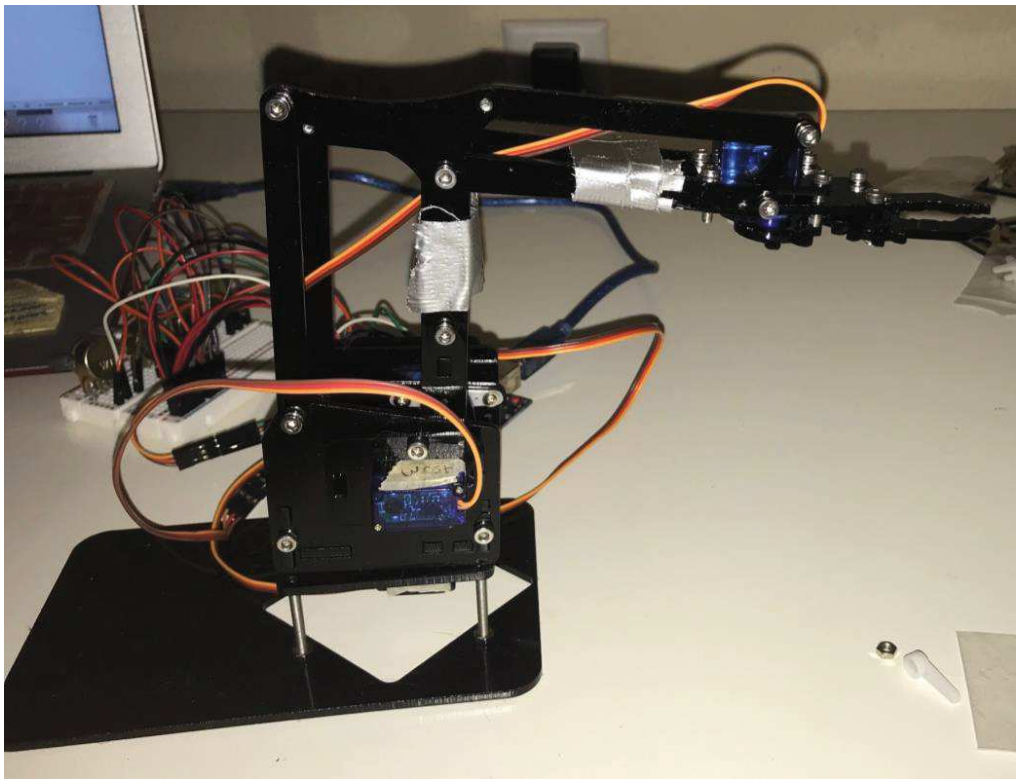


The screw needs to go into a hole in this piece. You may need to loosen other screws to make this work.

71. Use a medium or large screw to attach the top right side. Test to make sure the servo still works.



72. Put the robotic arm back on the base. Press down to pop the servo blade into the servo below it.



73. Use a tiny servo screw to secure the blade to the servo.