KANSAS STATE UNIVERSITY
ELECTRONICS
DESIGN CLUB

Useless Box Kit

Rev 4

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Kansas State University Electronics Design Club

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Instructions: David Schall

Required Materials

Quantity	Description
1	Double Pole Double Throw Switch
1	Micro Switch
1	Battery Holder
1	DC Geared Motor
1	Useless Box PCB
1	Useless Box Base Assembly (4 parts)
1	Useless Box Arm Assembly (4 parts)
3	Zip Tie
1	Red 22 Gauge Wire
1	Black 22 Gauge Wire
2	Yellow 22 Gauge Wire
1	#2 5/16” Screw

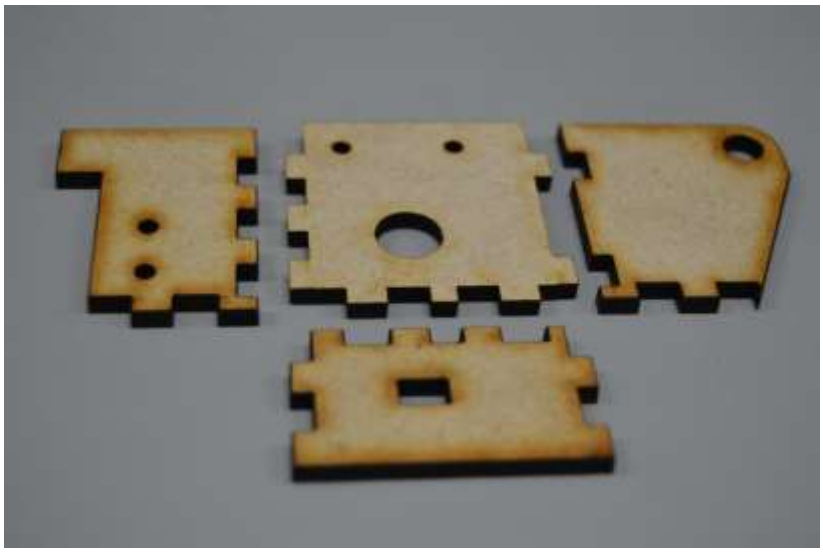
Required Tools

1. Soldering Iron
2. Phillips Screw Driver
3. Glue
4. Wire Strippers

Instructions

Step 1: Assembling the base

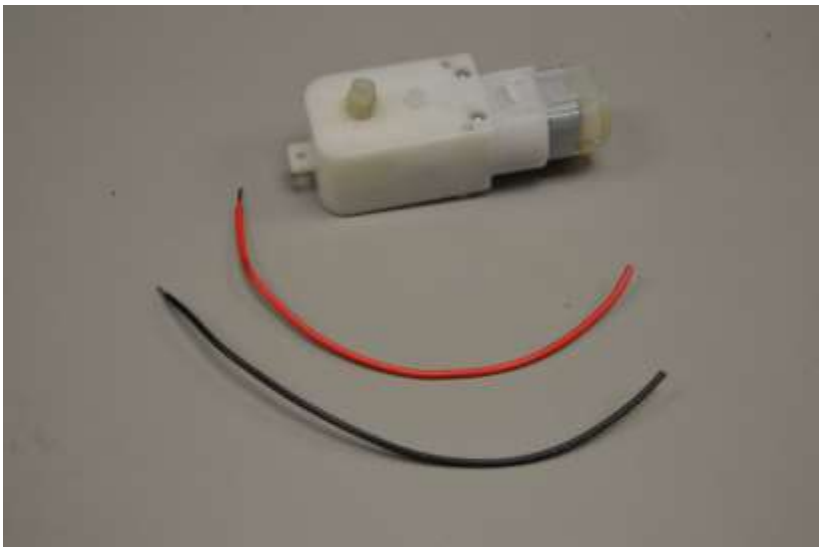
Glue together base assembly. We used tacky glue, but you can use wood glue or other adhesion methods.



Step 2: Wiring the Motor

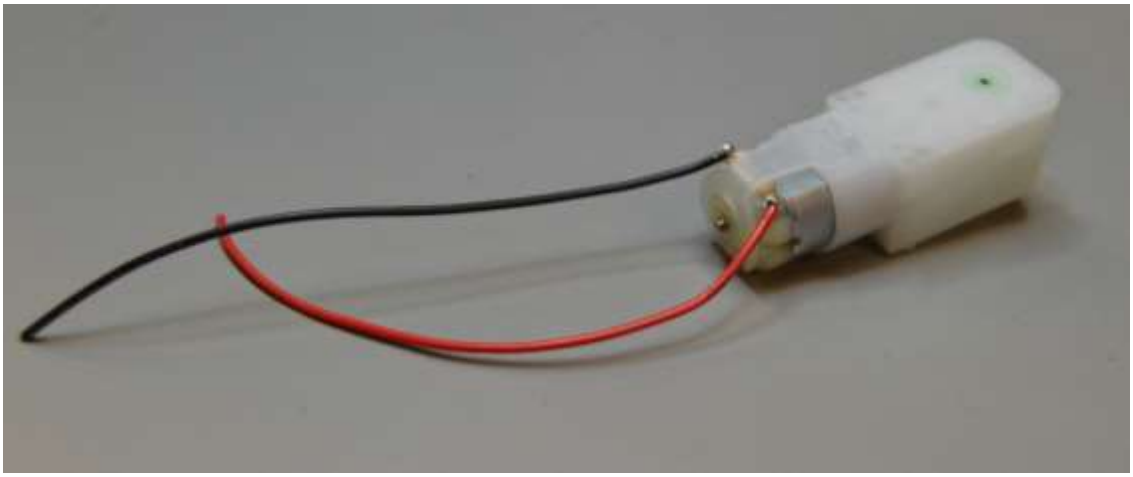
Required Materials

i) Geared Motor
ii) Red Wire
iii) Black Wire



Set the motor so the solder tabs on the motor are facing up. The red wire will attach on the right, black on the left.

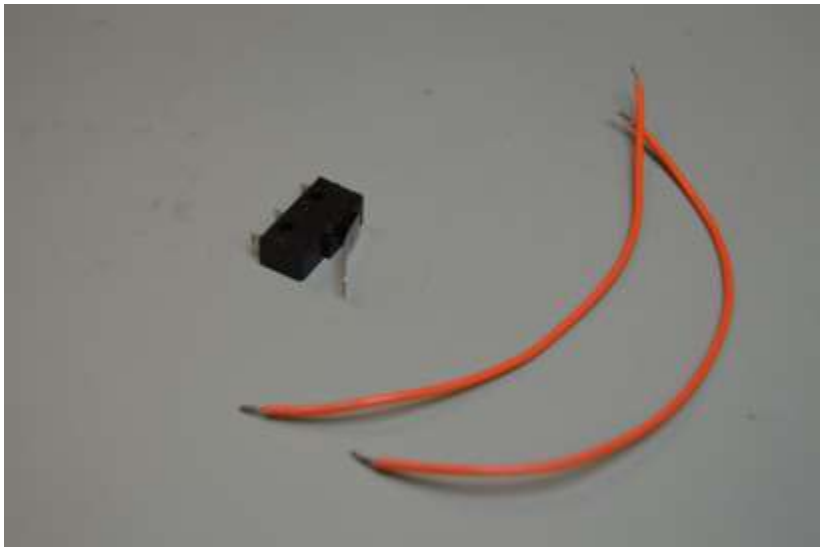
Solder the red and black wires to the motor.



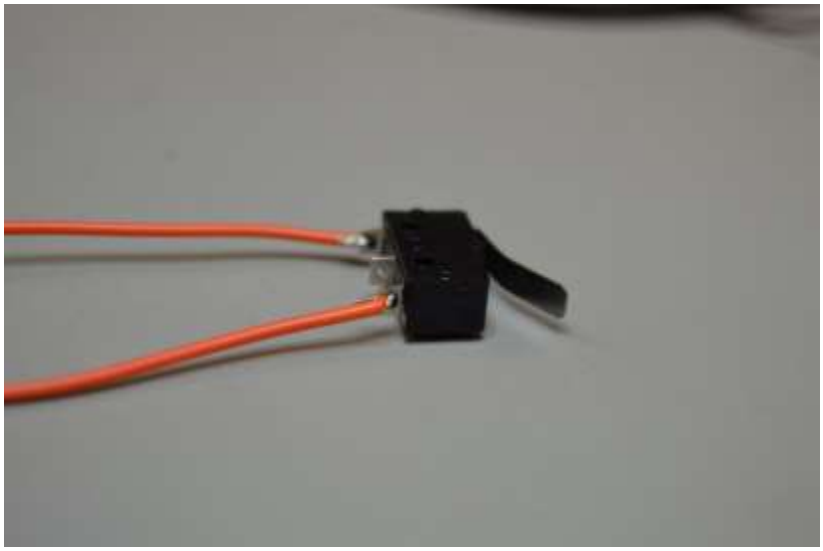
Step 3: Wire the Micro Switch

Required Materials

i) Micro Switch
ii) Yellow Wires (2)



Solder the wires to the micro switch. Solder one wire to the Common ‘C’ pole of the Micro Switch; solder the other to the Normally Closed ‘NC’ pole of the switch.



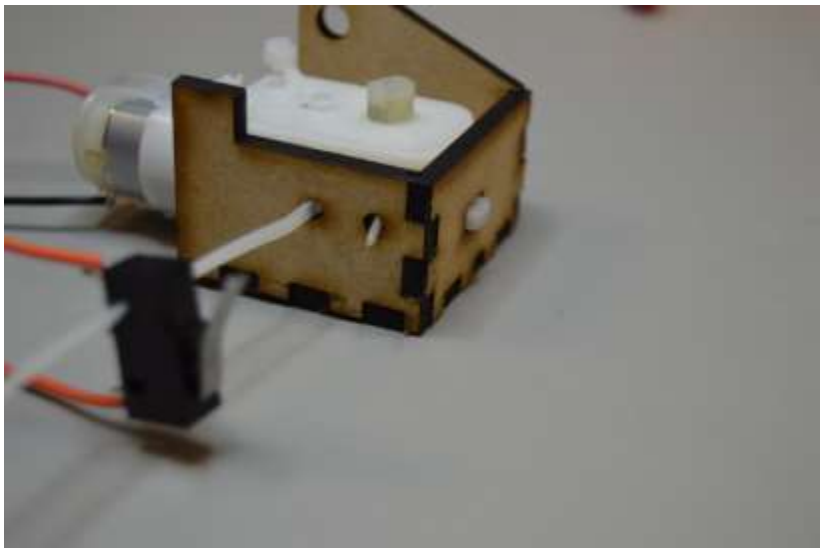
You may also need to bend up the metal on this switch to make sure the arm hits it. This can be done now or after the arm is installed.

Step 4: Install Micro Switch on the Base

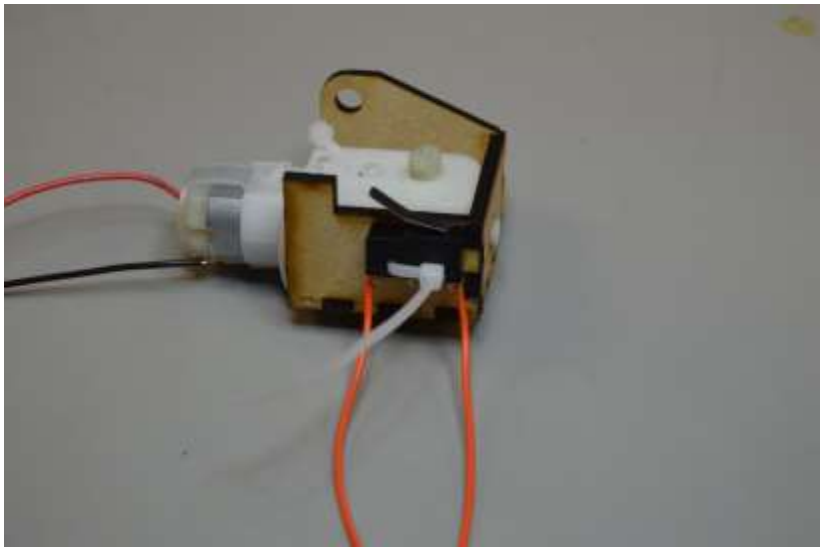
Required Material

i) Useless Box Base
ii) Micro Switch
iii) Zip Tie (1)

Feed zip tie through the holes on the Micro Switch and through the Base. Make sure to have the open side of the switch facing away from the back (left in picture). Loop zip tie back through second hole.



Secure and trim the zip tie.

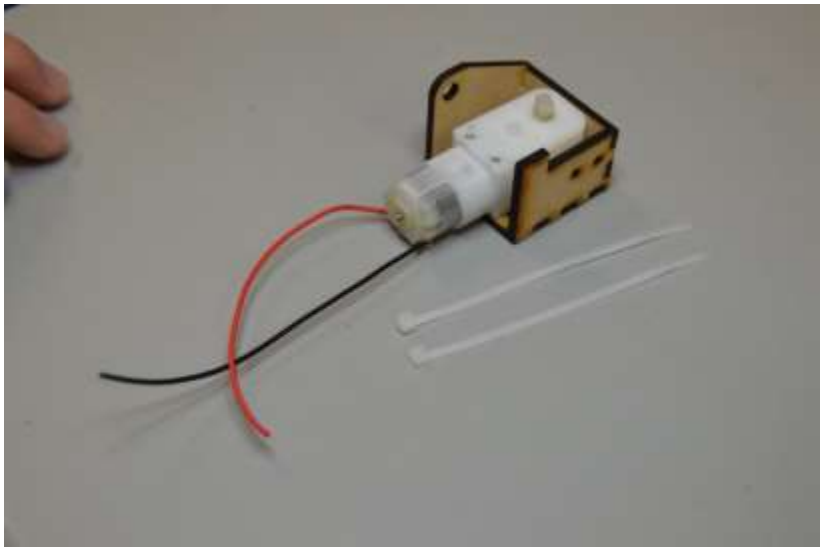


Step 5: Install Wired Motor

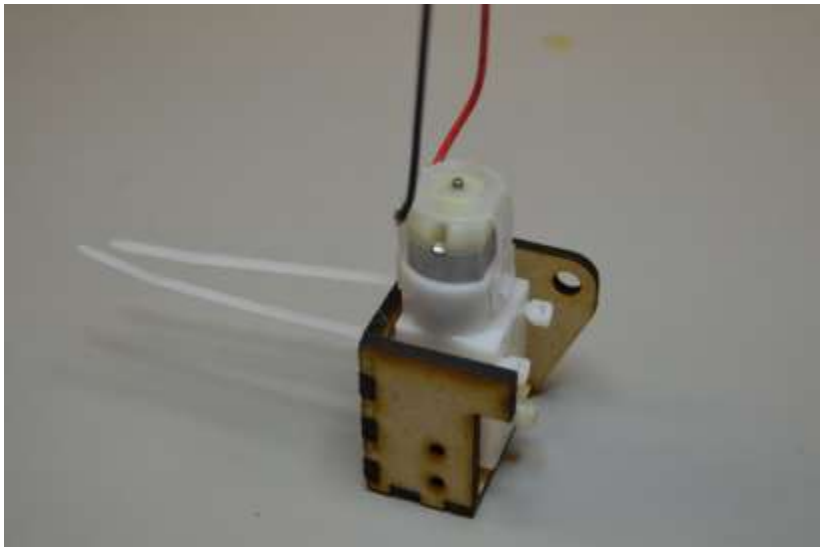
Required Materials

i) Wired Motor
ii) Assembled Base
iii) Zip ties (2)

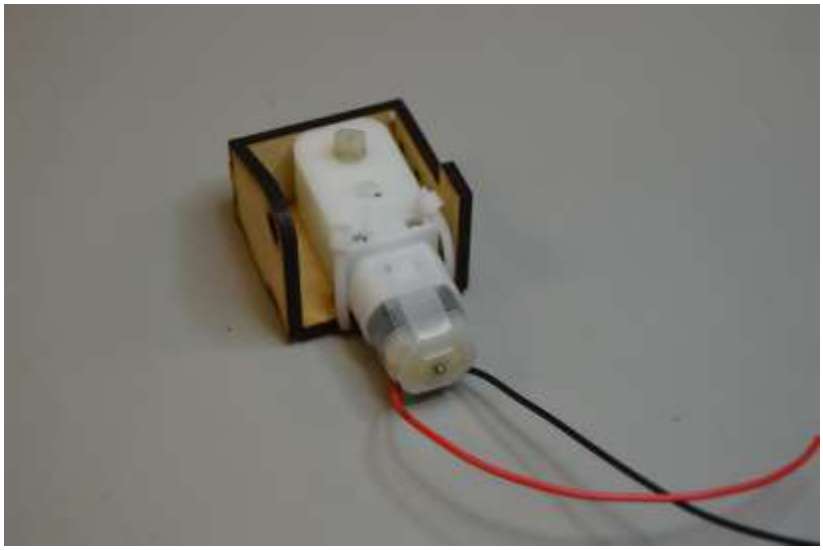
Place motor into base lining up motor extrusion with voids in the base.



Run zip ties through the holes in the Wired Motor and the Base.



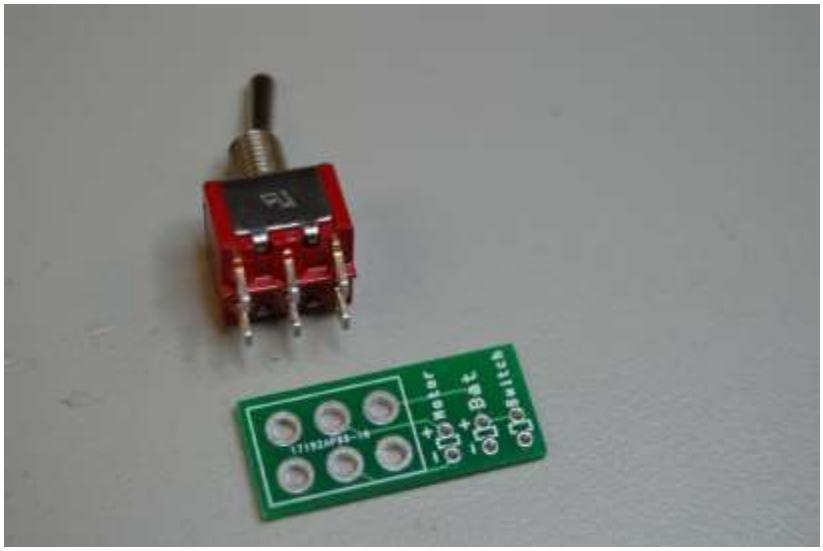
Tighten and trim zip ties.



Step 6: Solder the Switch on the PCB

Required Material:

i) Double Pole Double Throw Switch
ii) Useless Box PCB



Align and place switch onto the circuit board. Direction does not matter on this.

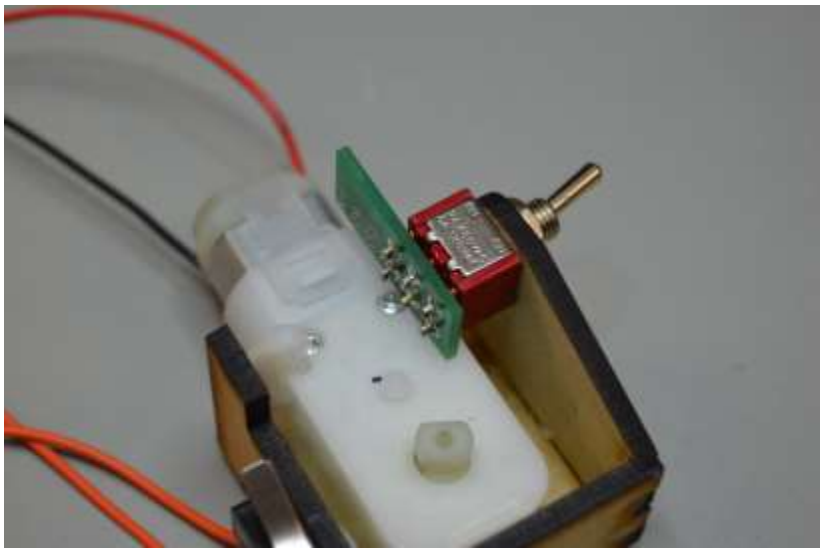
Solder tabs onto the PCB. Remove nuts and washers from switch.

Step 7: Attach Switch to Base

Required Materials

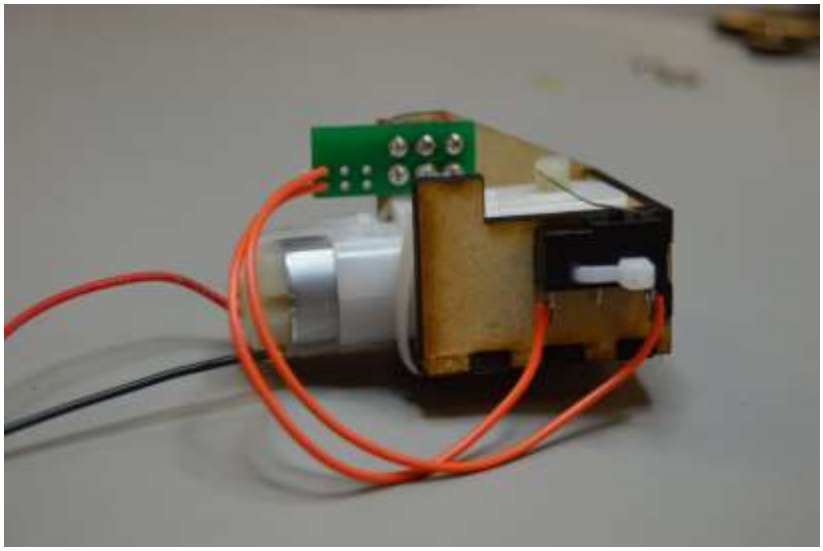
i) Assembled Useless Box Base
ii) Soldered Switch

Insert the switch into the hole of the base. Reinstall the washers and nuts to secure the switch.



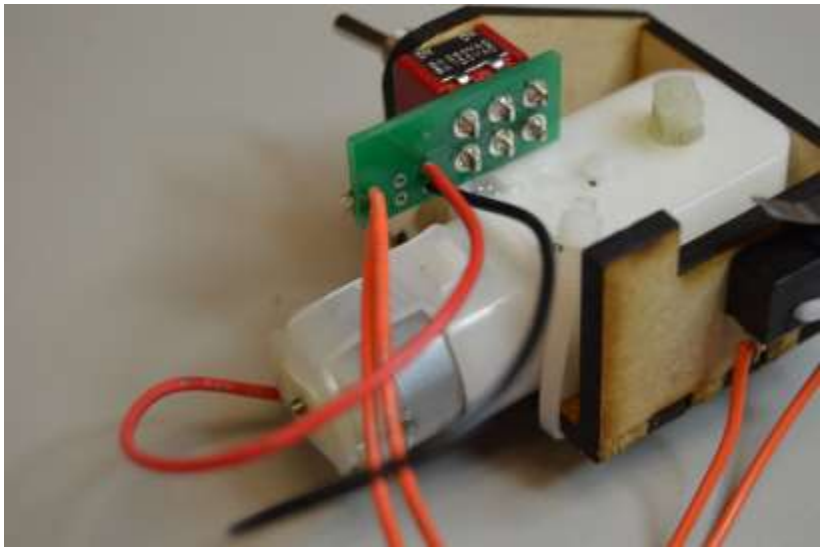
Step 8: Wire the Micro Switch to the PCB

Solder the two yellow (or orange) wires to the Switch connections on the PCB. Polarity does not matter.



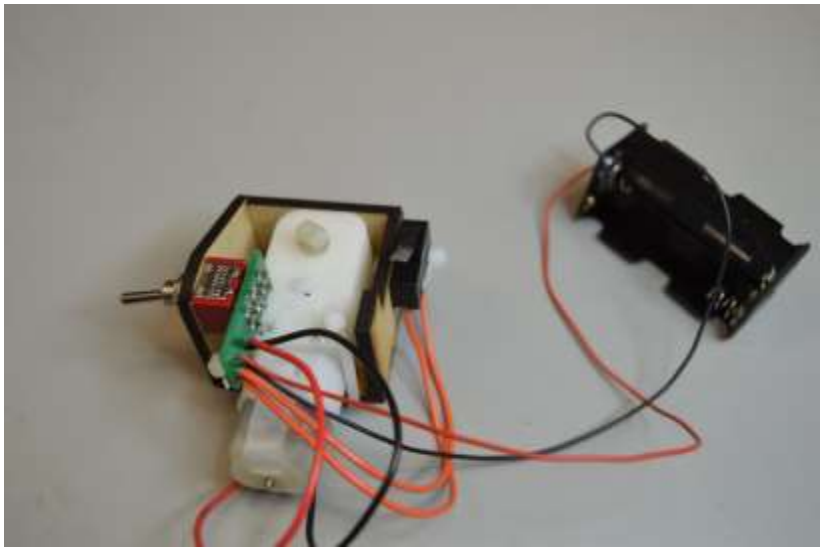
Step 9: Wire the Motor to the PCB

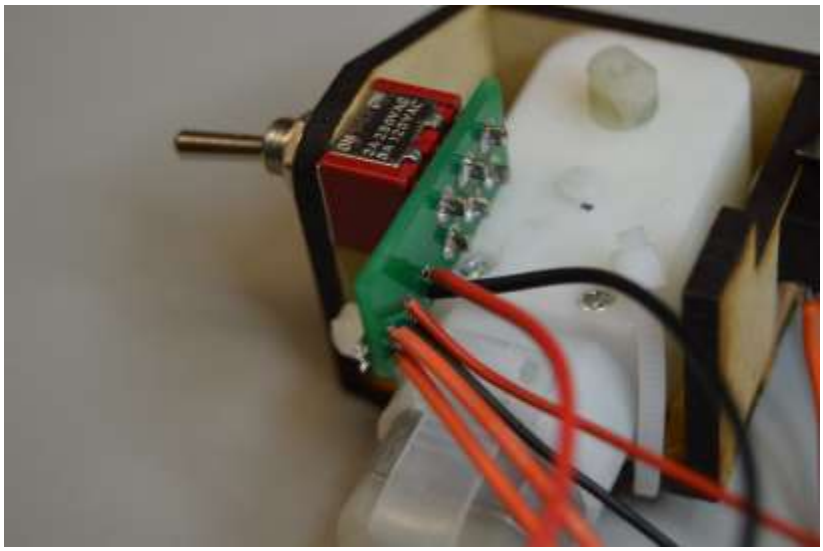
Solder the red (+) and the black (-) to the motor holes on the PCB.

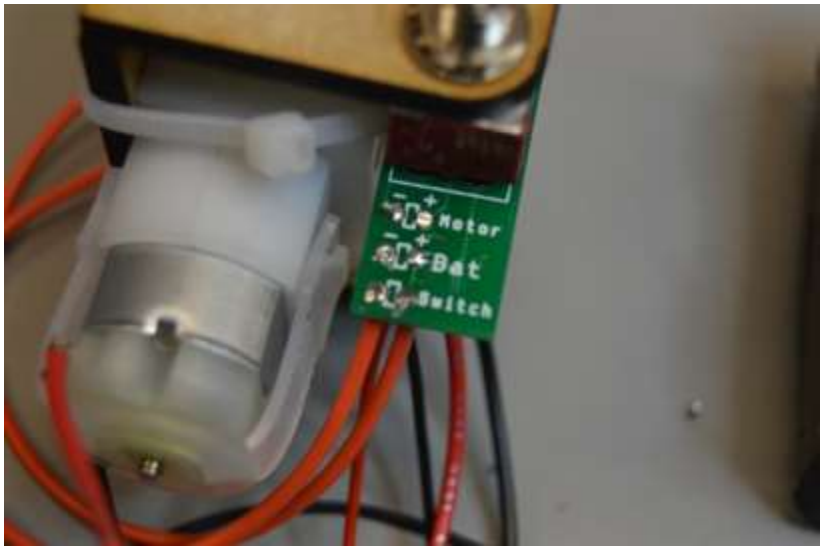


Step 10: Solder Battery Holder Leads to PCB

Solder the red (+) and the black (-) to the battery holes on the PCB.






Motor
Bat
Switch

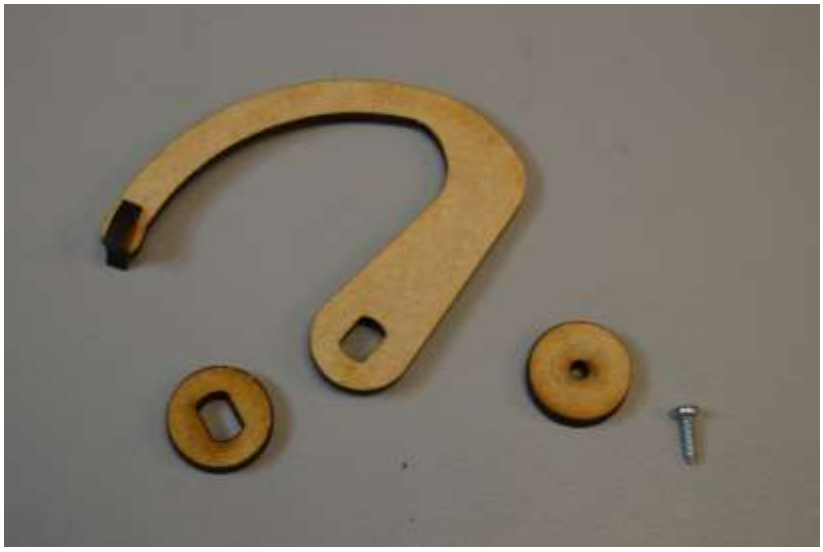
Step 11: Install Arm on Motor

Required Materials

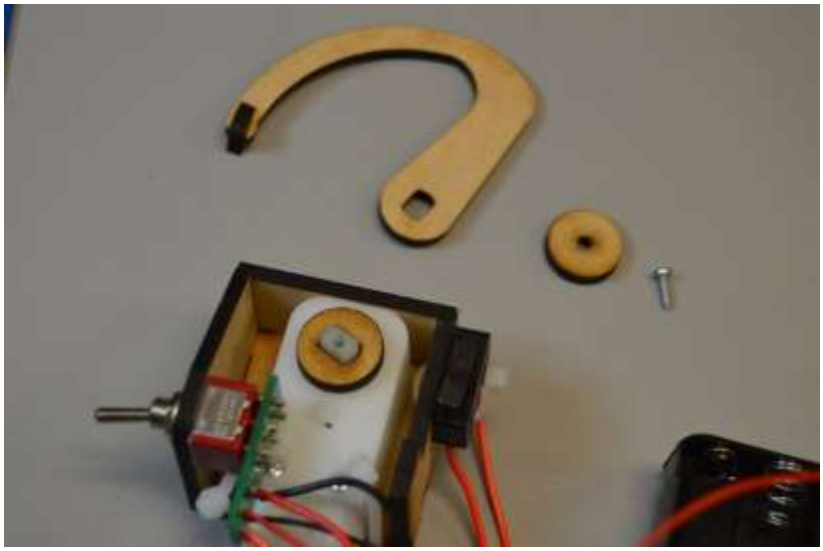
i) Arm Pieces (4)
   a. Center Plunger
   b. Washer
   c. Spacer
   d. Arm
ii) #2 Screw
iii) Useless Box Assembly

Insert Center Plunger into arm (this will be a tight fit and should not have to be glued).

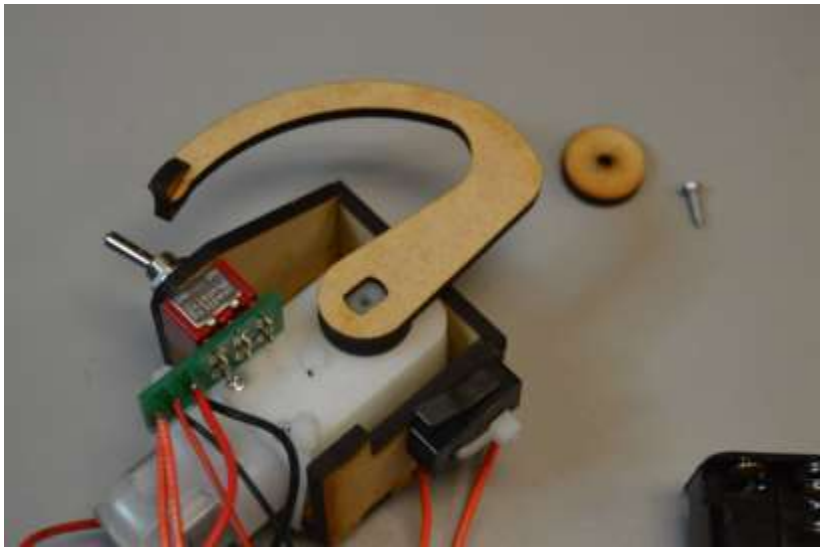
Gather remaining pieces.



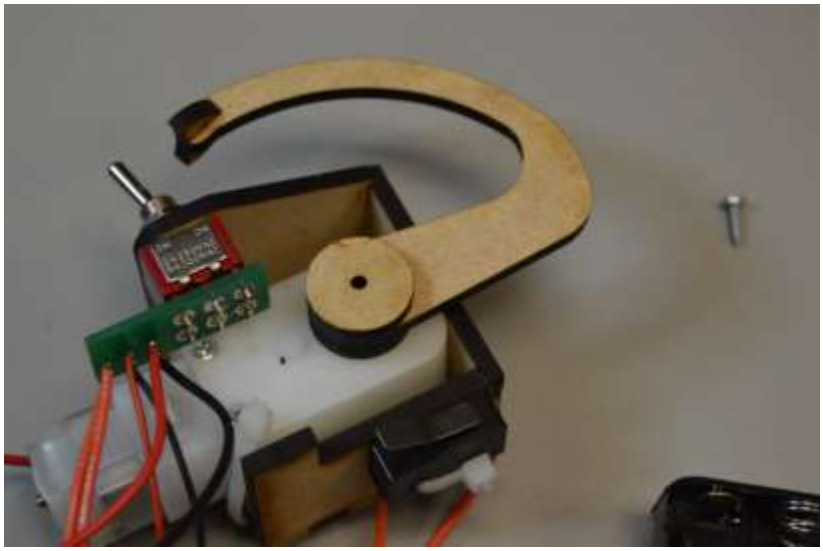
Insert spacer on motor shaft.



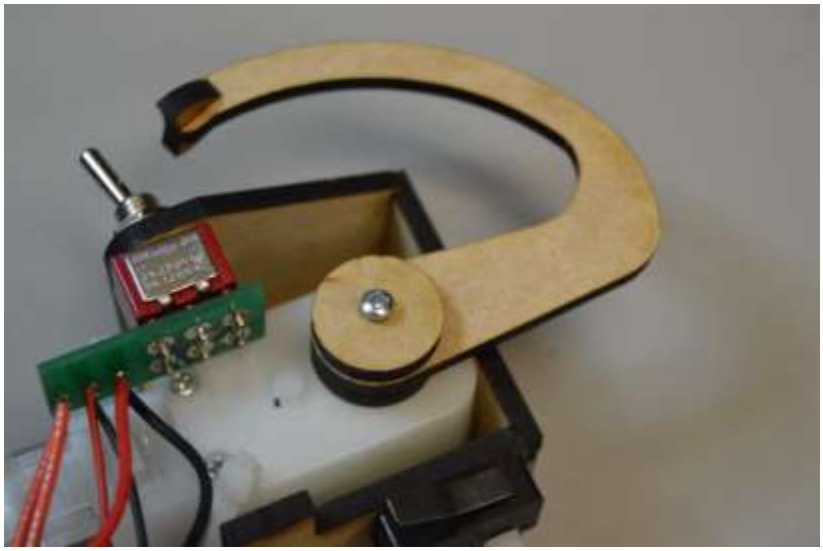
Place arm on top of spacer on motor shaft.



Align washer on top of arm with hole in shaft. Smaller hole in the washer should be facing up.



Align and install screw to motor shaft through washer.



Step 12: Test the Useless Box!

a) Install 4 AA batteries into the battery holder
b) Toggle the switch forward, This should cause the motor to rotate counter clockwise
c) Toggle the switch backwards, This should cause the motor to rotate clockwise
d) Press the micro switch
    i) While the toggle switch is in the back position, this should stop the motor
    ii) This should have no effect when the switch is forward
e) If the Motor spins the opposite direction
    i) Remove the batteries from the system
    ii) Unsolder the red and black wires from the motor and rewire in the opposite polarity.
    iii) Repeat step 12

General Troubleshooting

1. When the motor returns to the off position the power should automatically be removed from the motor.
    a. If the motor does not want to rotate, power is still being supplied to the motor, remove batteries and bend the micro switch up more, then try again.
2. Rotate the motor counter clockwise until the motor gains power and returns to the off position

ENJOY