KANSAS STATE UNIVERSITY
ELECTRONICS
DESIGN CLUB

Useless Box Kit

Rev 2

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Kansas State University Electronics Design Club
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Required Materials:

Quantity	Description
1	Double Pole Double Throw Switch
1	Micro Switch
1	Battery Pack
1	DC Geared Motor
1	Useless Box PCB
1	Useless Box Base
1	Useless Box Arm
1	4inch Zip Tie
1	8inch Zip Tie
1	Red 22 gauge wire – 4 inches long
1	Black 22 gauge wire – 4 inches long
2	Orange 22 gauge wire – 4.5 to 5 inches long
1	#2 by 5/16 inch screw

Detailed documentation on required materials can be found at the end of this document.

Required Tools:

1. Soldering Iron
2. Wire Cutters
3. Wire Strippers
4. Hot Glue Gun

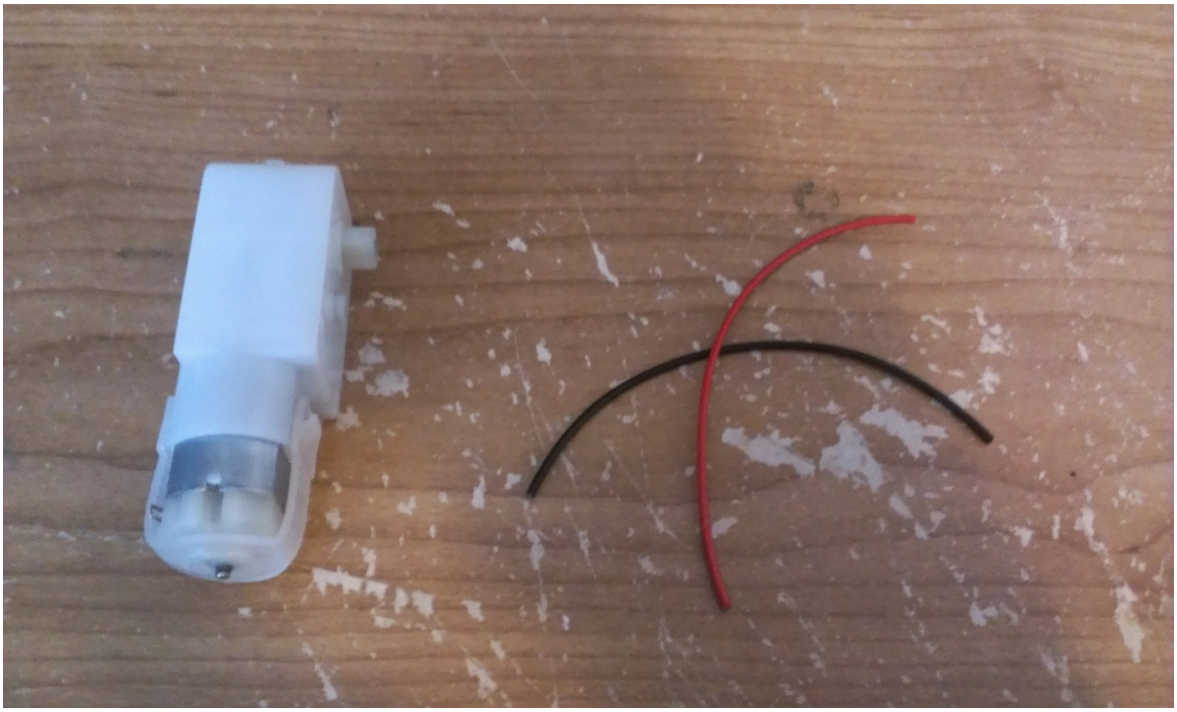
Build Documentation:

Step 1: Gather All Required Materials

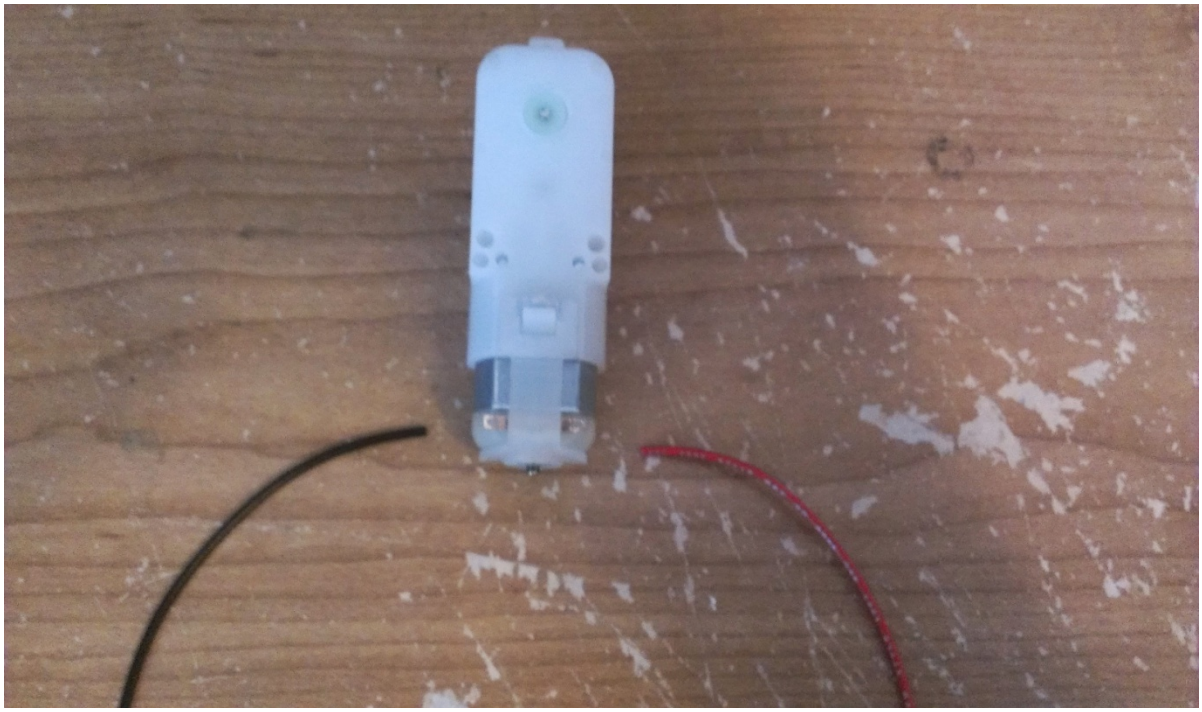
a) Before starting assembly ensure you have all the required tools and material.

Step 2: Wiring the motor

a) Required Material:
   i) Geared Motor
   ii) Red Wire
   iii) Black Wire



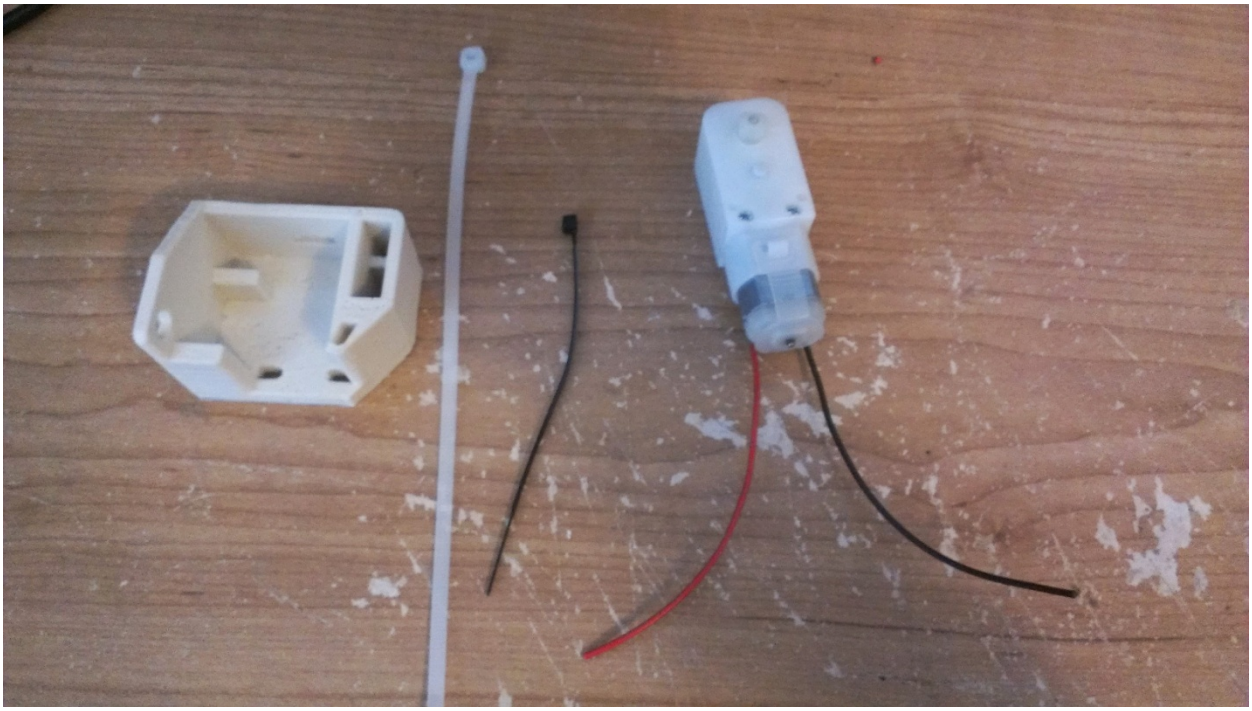
b) Set the motor so the solder tabs on the motor are facing up. The red wire will attach on the right, black on the left.



c) Solder the red and black wires to the motor.

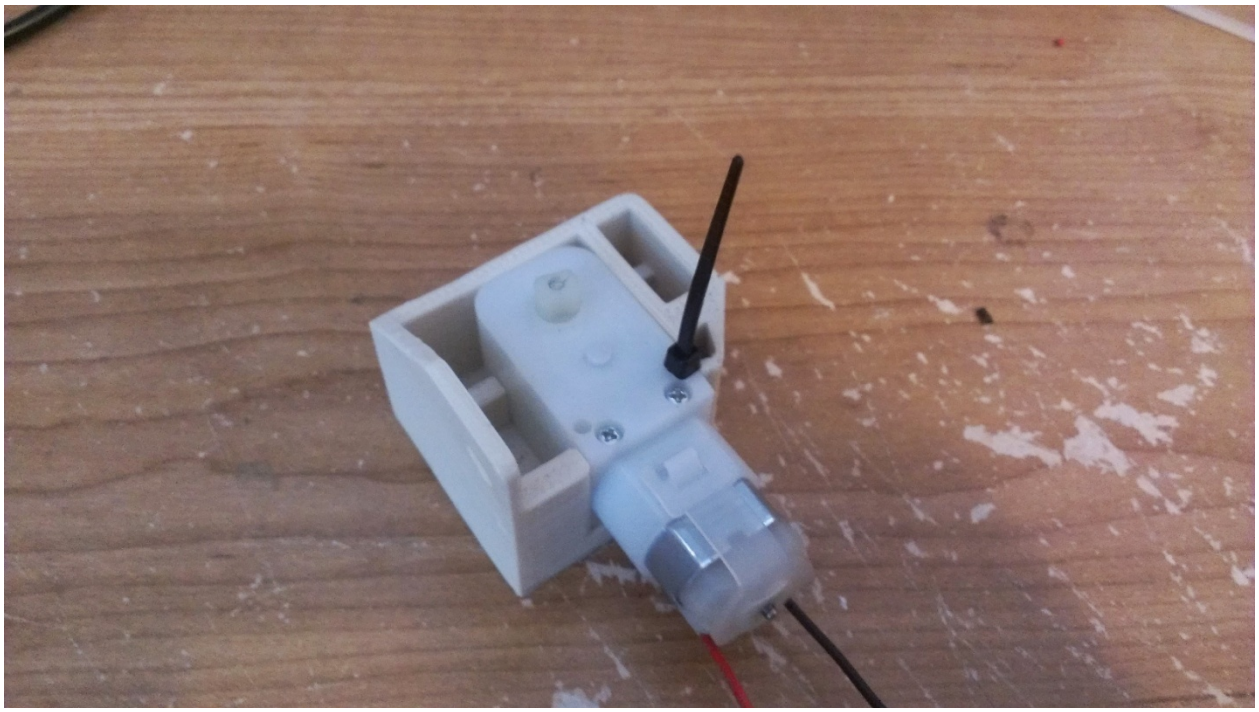
Step 3: Assemble the Main Body

a) Required Material:
   i) Wired Motor
   ii) Useless Box Base
   iii) 4 inch zip tie
   iv) 8 inch zip tie

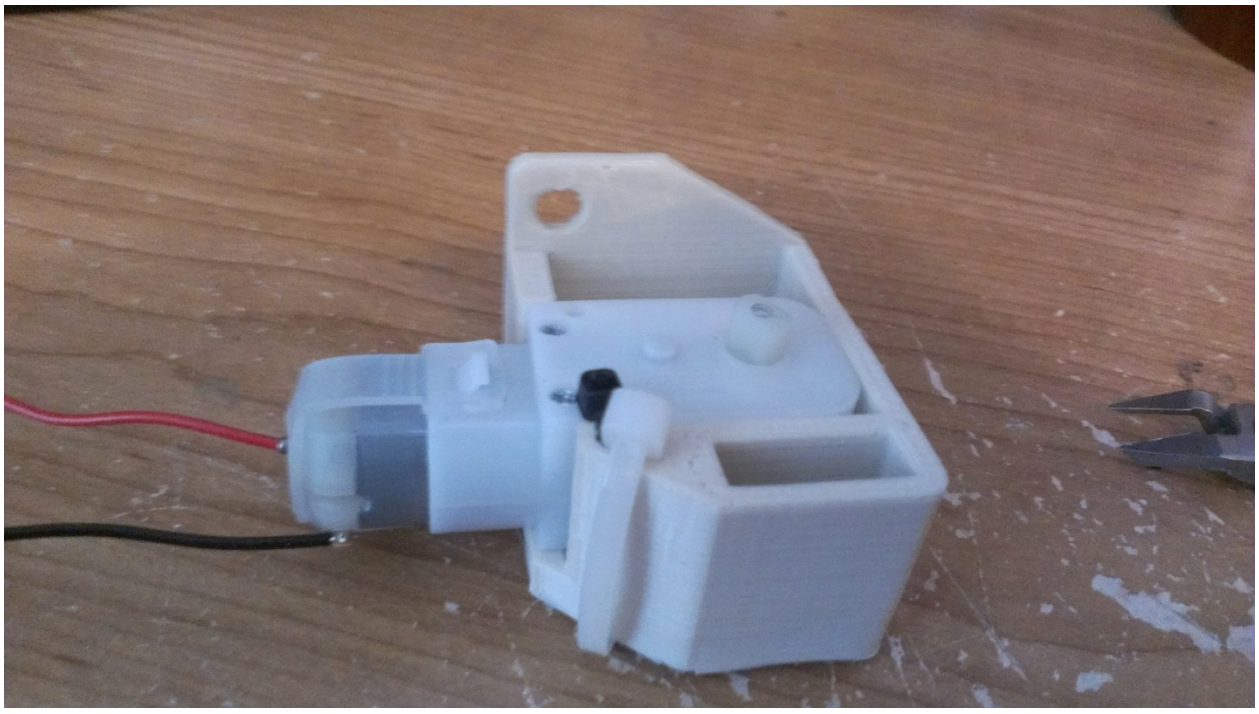


b) Insert Motor into the Base.

c) Use the 4 inch zip tie to secure the motor to the base.
    i) Run the zip tie through the hole in the motor and the base to secure it.



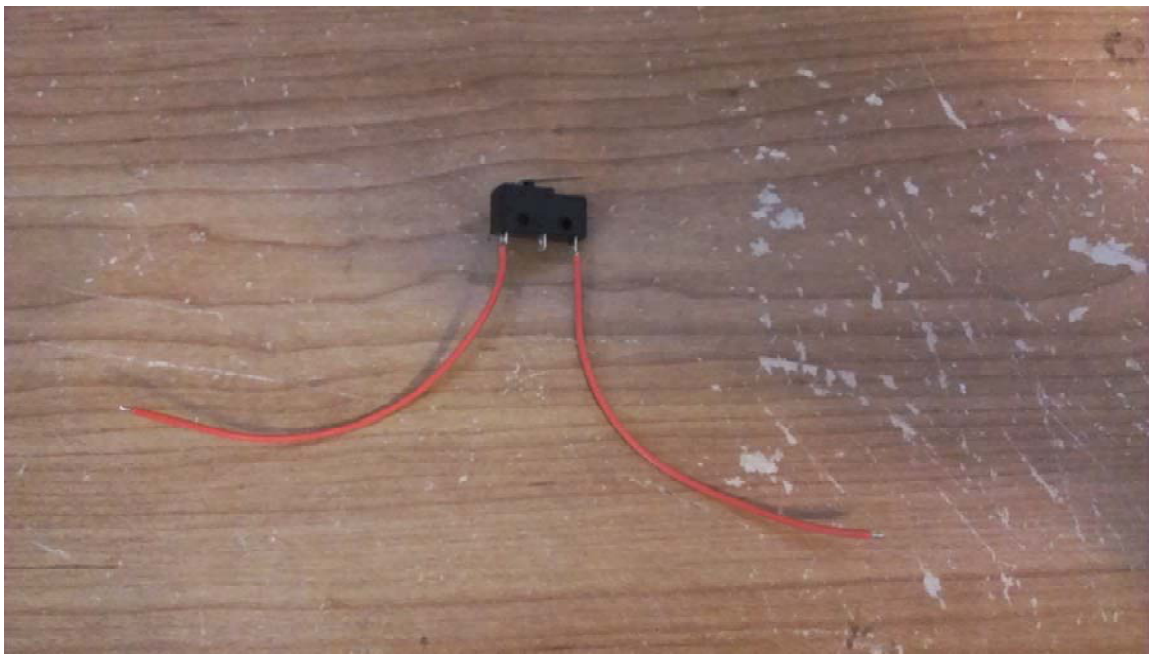
d) Install the 8 inch zip tie
    i) This zip tie is used as a backstop for the motor, to limit its rotation range.
    ii) Run the zip tie through the hole on the base and long the side. The zip tie should be installed as shown in the image below.
e) Clip the excess from the zip ties.



Step 4: Wire the Micro Switch

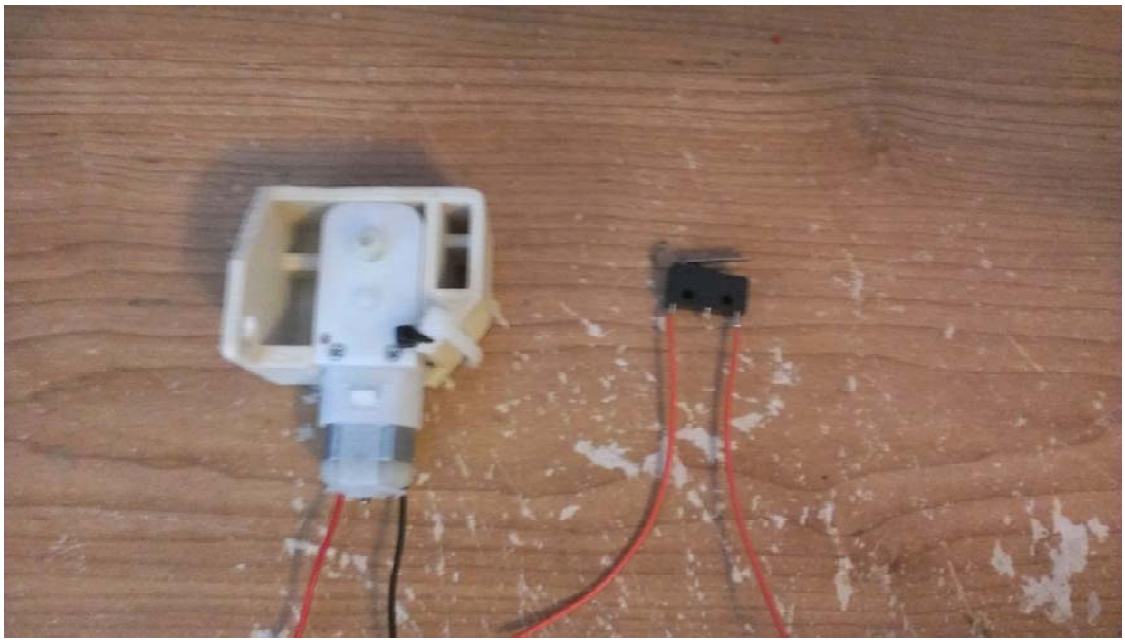
a) Required Material:
   i) Micro Switch
   ii) Both Orange Wires

b) Solder the Orange Wires to the Micro Switch
   i) Solder one wire to the Common (C) pole of the Micro Switch
   ii) Solder the other wire to the Normally Closed (NC) pole of the Micro Switch

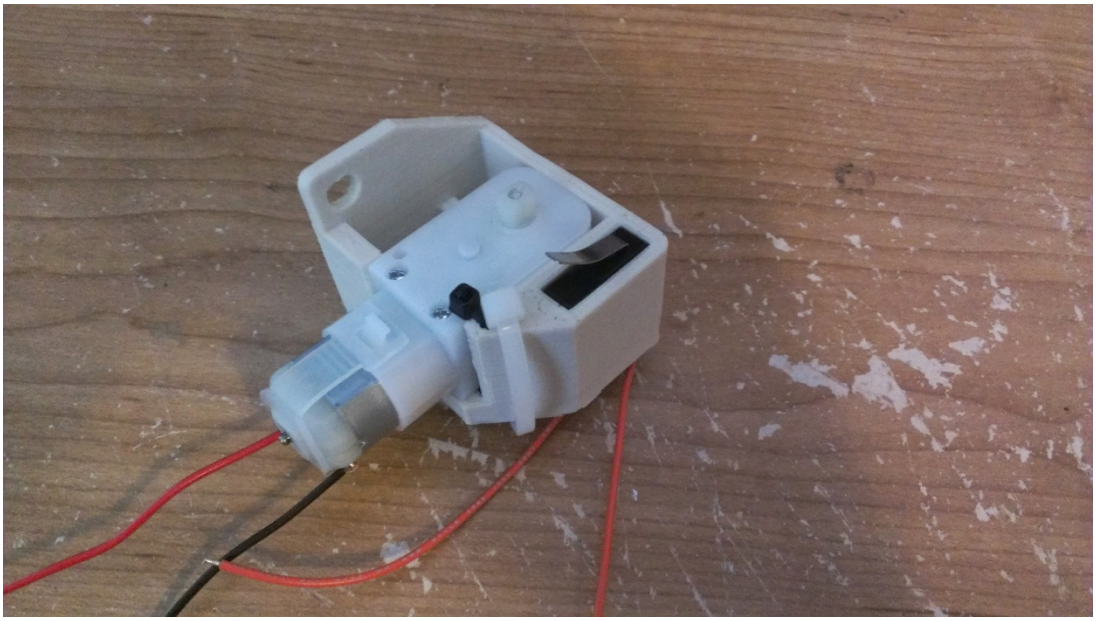


Step 5: Install Micro Switch into the Base

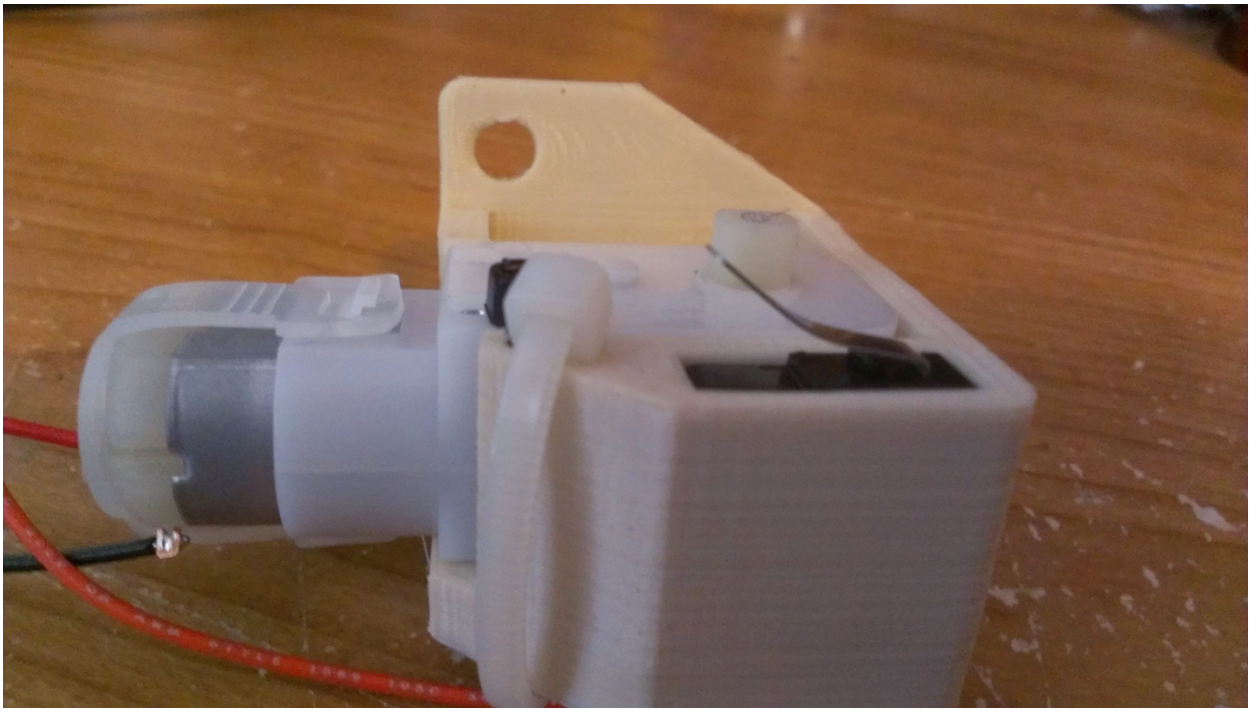
a) Required Material:
   i) Useless Box Base
   ii) Micro Switch



b) Insert the Micro Switch into the base. The lever on the switch should point to the rear of the Geared Motor.

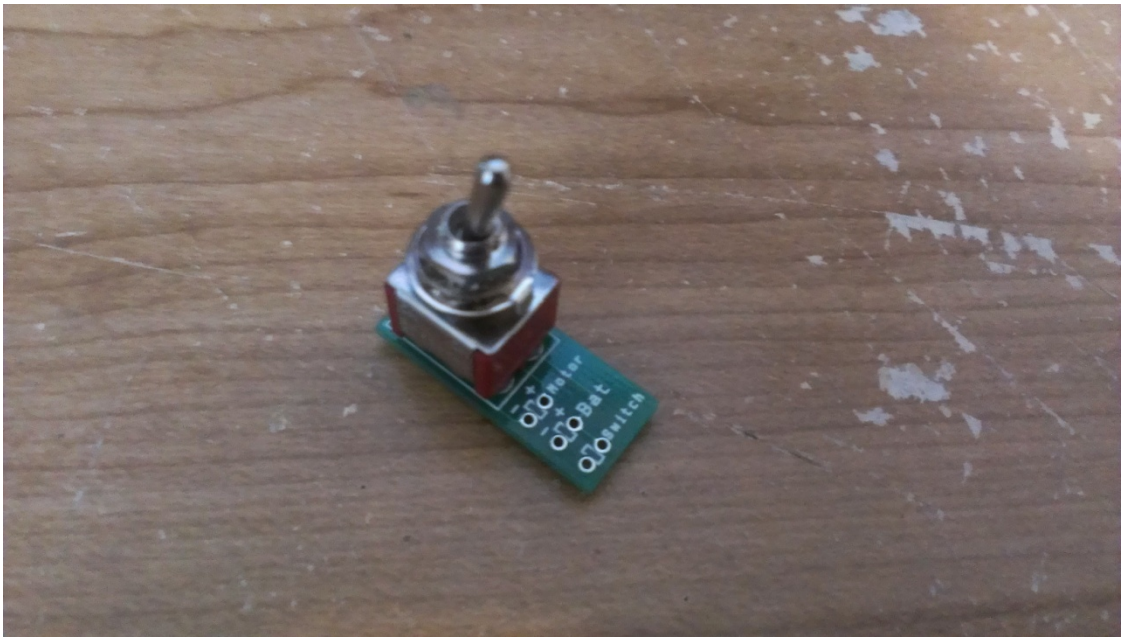


c) If the fit is loose use a bit of hot glue to secure the switch.
d) Once switch is secured, bend the lever on the switch upwards. This will make it easier for the arm to trigger the switch.



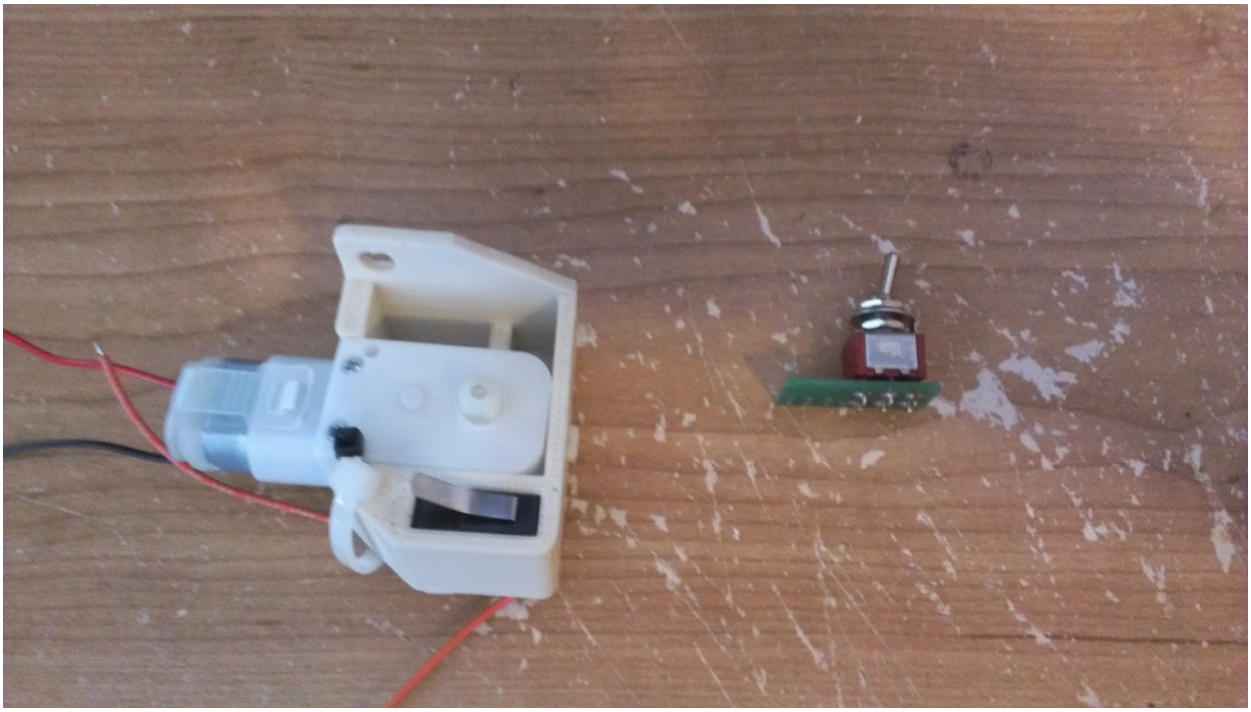
Step 6: Solder Switch Together

a) Required Material:
   i) Double Pole Double Throw Switch
   ii) Useless Box PCB
b) Solder the PCB onto the switch

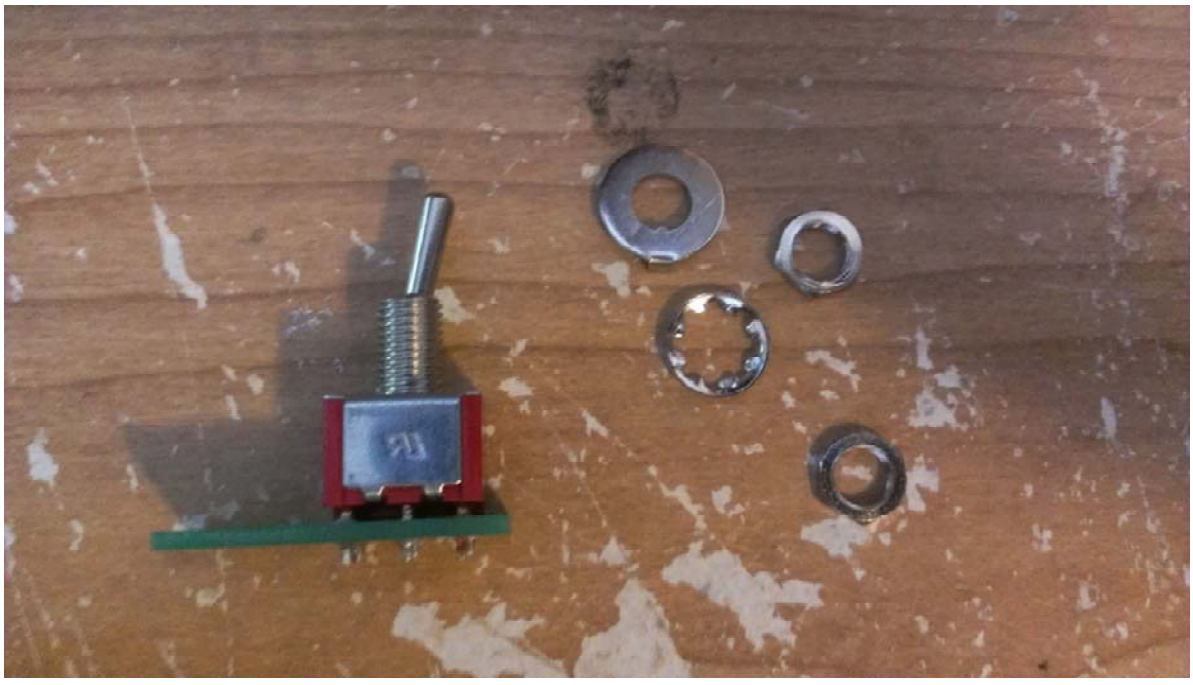


Step 7: Attach Switch to the Base

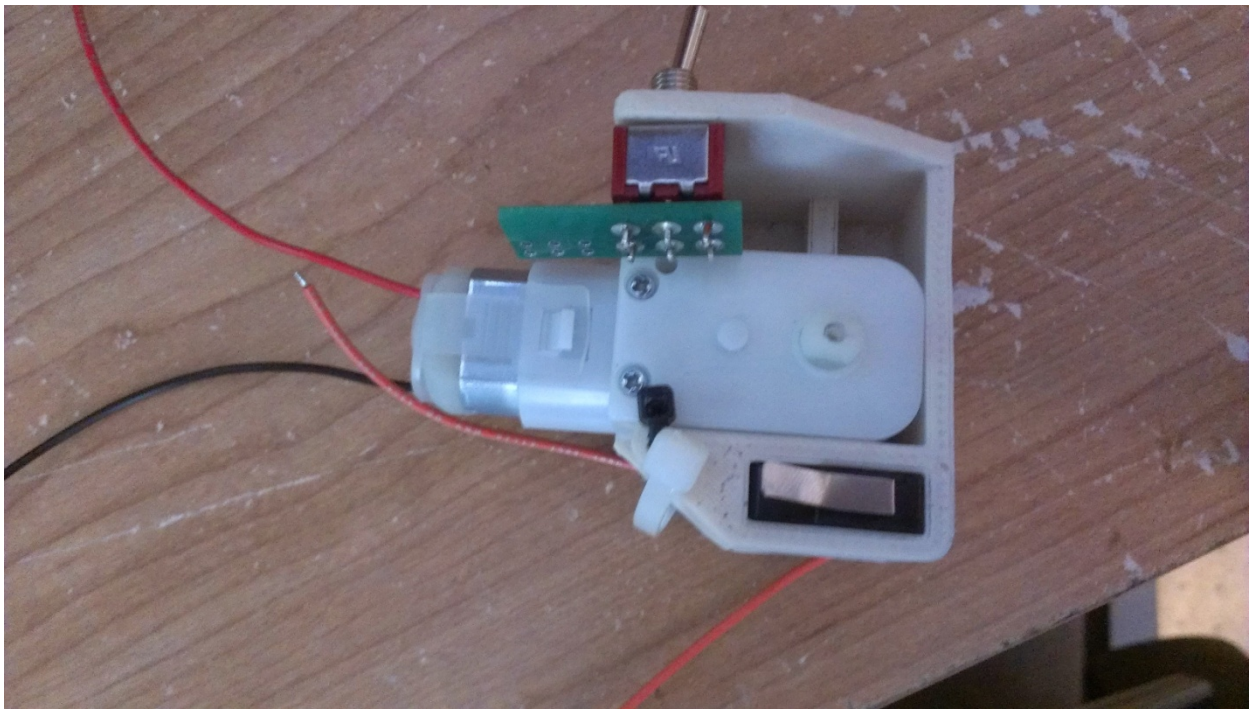
a) Required Material:
   i) Soldered Switch
   ii) Useless Box Base



b) Remove the nuts and washers from the switch

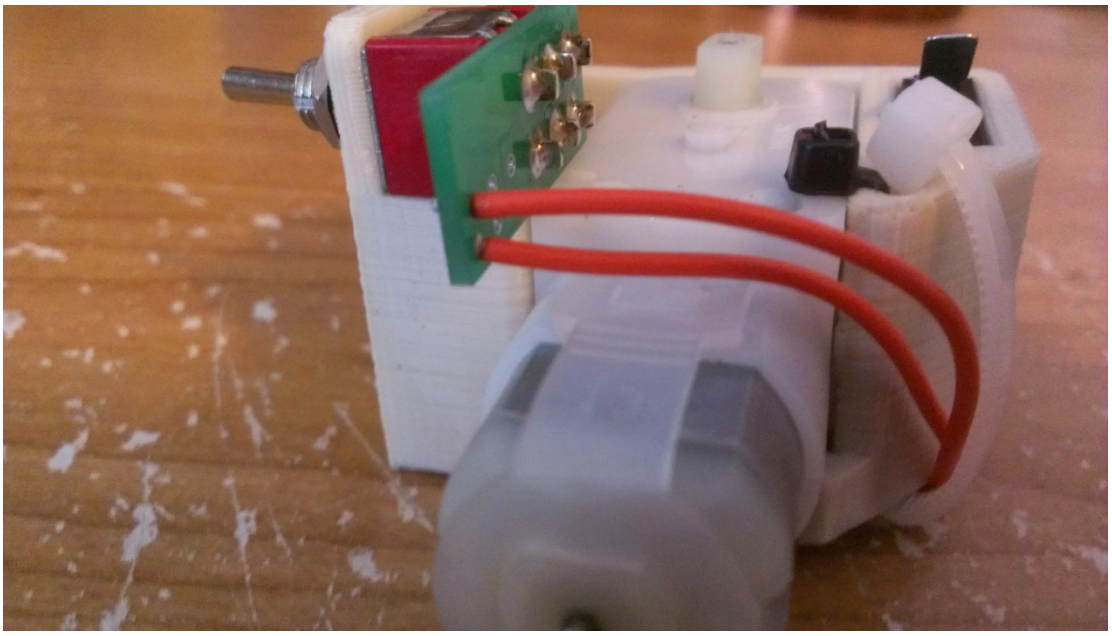


c) Insert the switch into the base, reinstall the nuts to secure the switch into the base



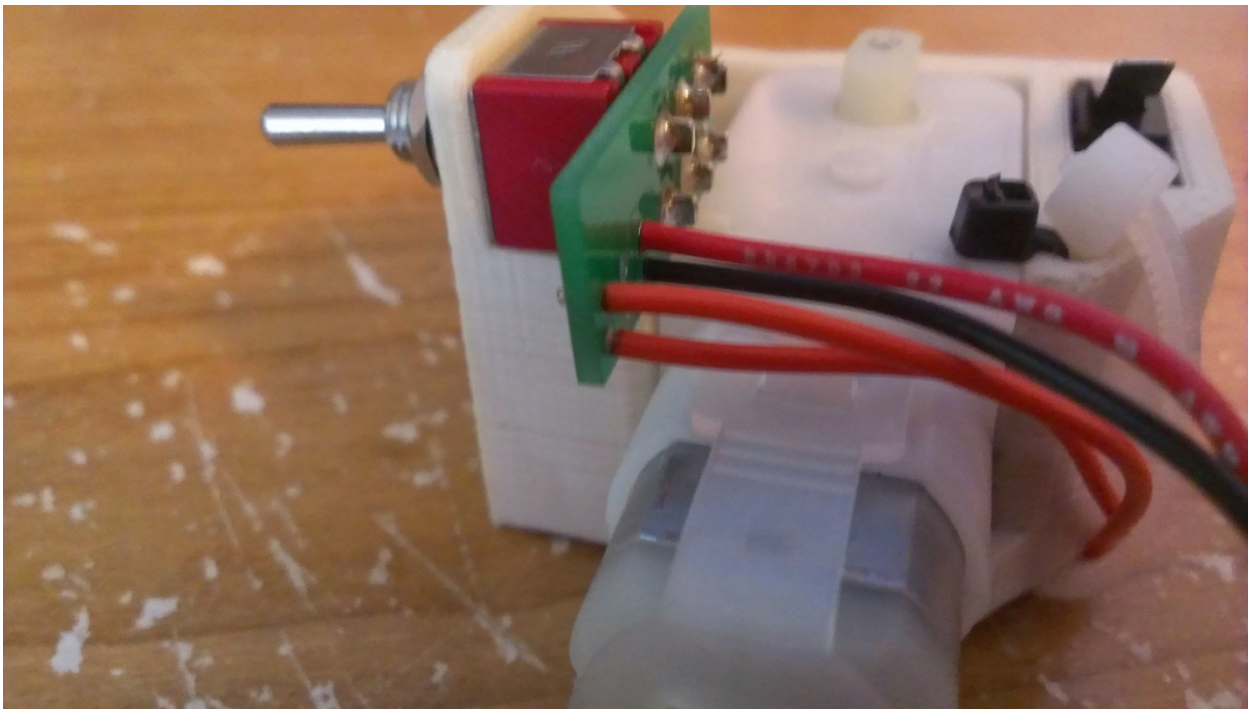
Step 8: Wire the Micro Switch to the Switch

a) Solder the two orange wires to the Switch connections on the PCB
   i) It does not matter what orange wire goes to which switch connection



Step 9: Wire the Motor to the Switch

a) Solder the red (+) and black (-) to the motor connections on the PCB.
    i) The red wire goes to the + motor connection
    ii) The black wire goes to the – motor connection



Step 10: Wire the Battery to the Switch

a) Solder the red (+) and black (-) to the battery connections on the PCB.
    i) The red wire goes to the + battery connection
    ii) The black wire goes to the – battery connection

Step 11: Test the system

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 11

Step 12: Remove the batteries

Step 13: Install the arm

a) Take the Useless Box Arm and press fit onto the motor shaft
    i) This is a tight fit and might take a bit of force to install
b) Once installed, use the #2 screw to secure the arm to the motor

Step 14: Reinstall the batteries

a) Install the batteries back into the battery holder
b) The arm should automatically go to its off potion
    i) The arm may move forward and flip the switch, if the switch was forward when power was applied.

Step 15: Test the system

a) When the motor returns to the off position the power should automatically be removed from the motor
    i) 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.
b) Rotate the motor counter clockwise until the motor gains power and returns to the off position

ENJOY

Material Details:

Part:	Known Supplier:	Website Link:
Double Pole Double Throw Switch	taydaelectronics.com	http://www.taydaelectronics.com/mini-toggle-switch-dpdt-on-on.html
Microswitch	taydaelectronics.com	http://www.taydaelectronics.com/mx-90-c-02-micro-switch-1p2t-1a-mx-90-c-02-rohs.html
4 AA Battery holder	taydaelectronics.com	http://www.taydaelectronics.com/aa-battery-holder-3.html
Geared Motor	pololu.com	http://www.pololu.com/product/1120
3D Printed Base and Arm		file provided in documentation
PCB	http://smart-prototyping.com/	file provided in documentation
Red 22 guage wire		
Black 22 guage wire		
Orange 22 guage wire		
Screw #2x5/16	mcmaster.com	http://www.mcmaster.com/#90190a077/=r8l6ye