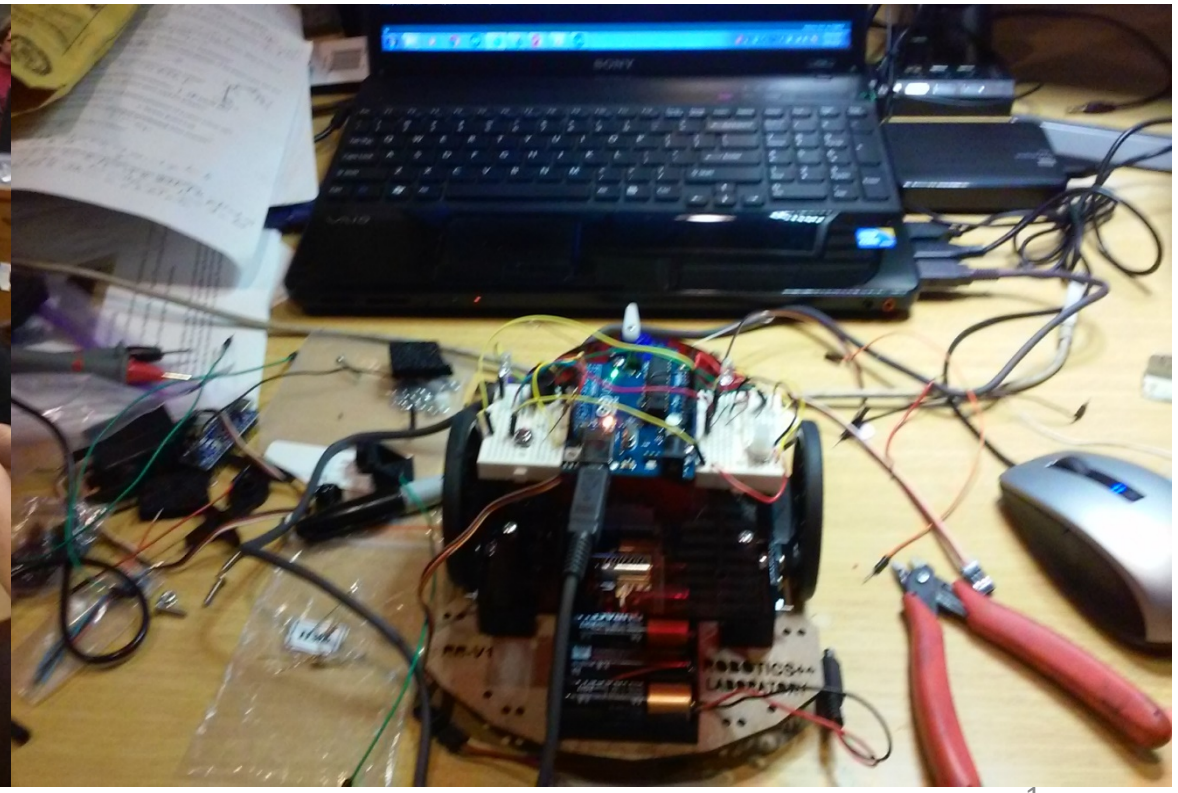
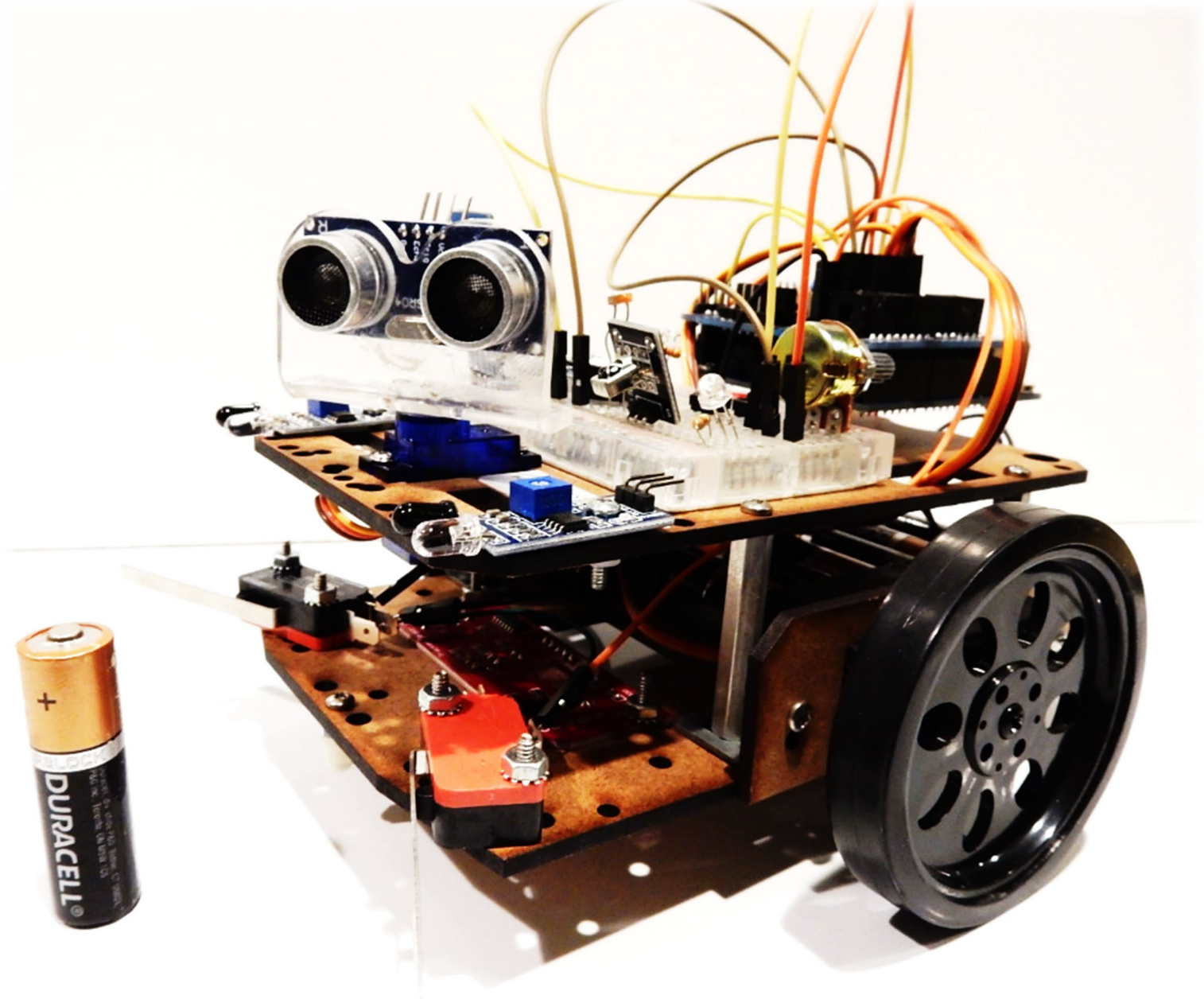
How to Build the Robotics++ V3 Robot

Updated 8-7-2020



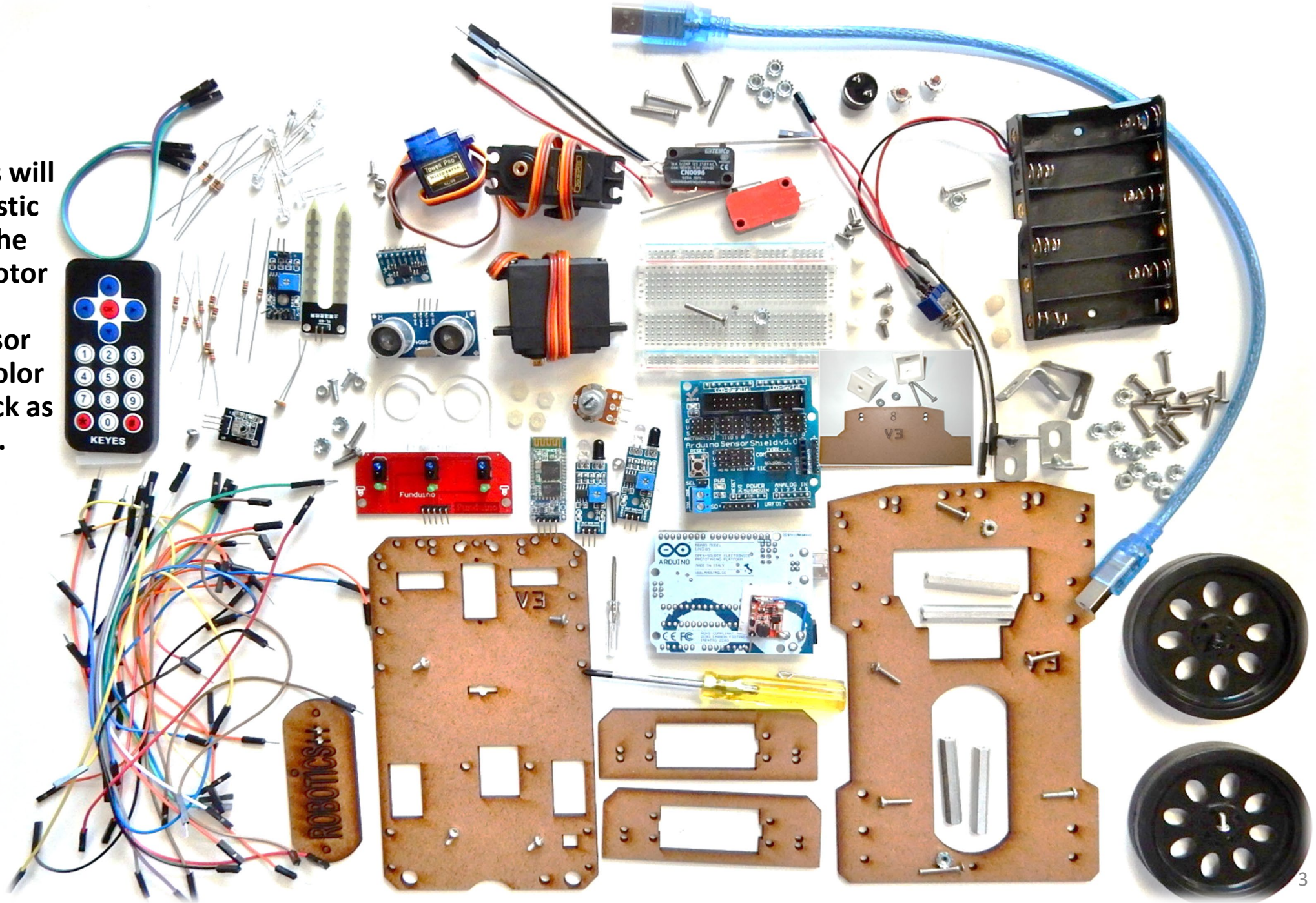
Completed Robotics++ V3 Robot.
More views of completed robot can be found at the end of this instructions manual

The fun starts now!

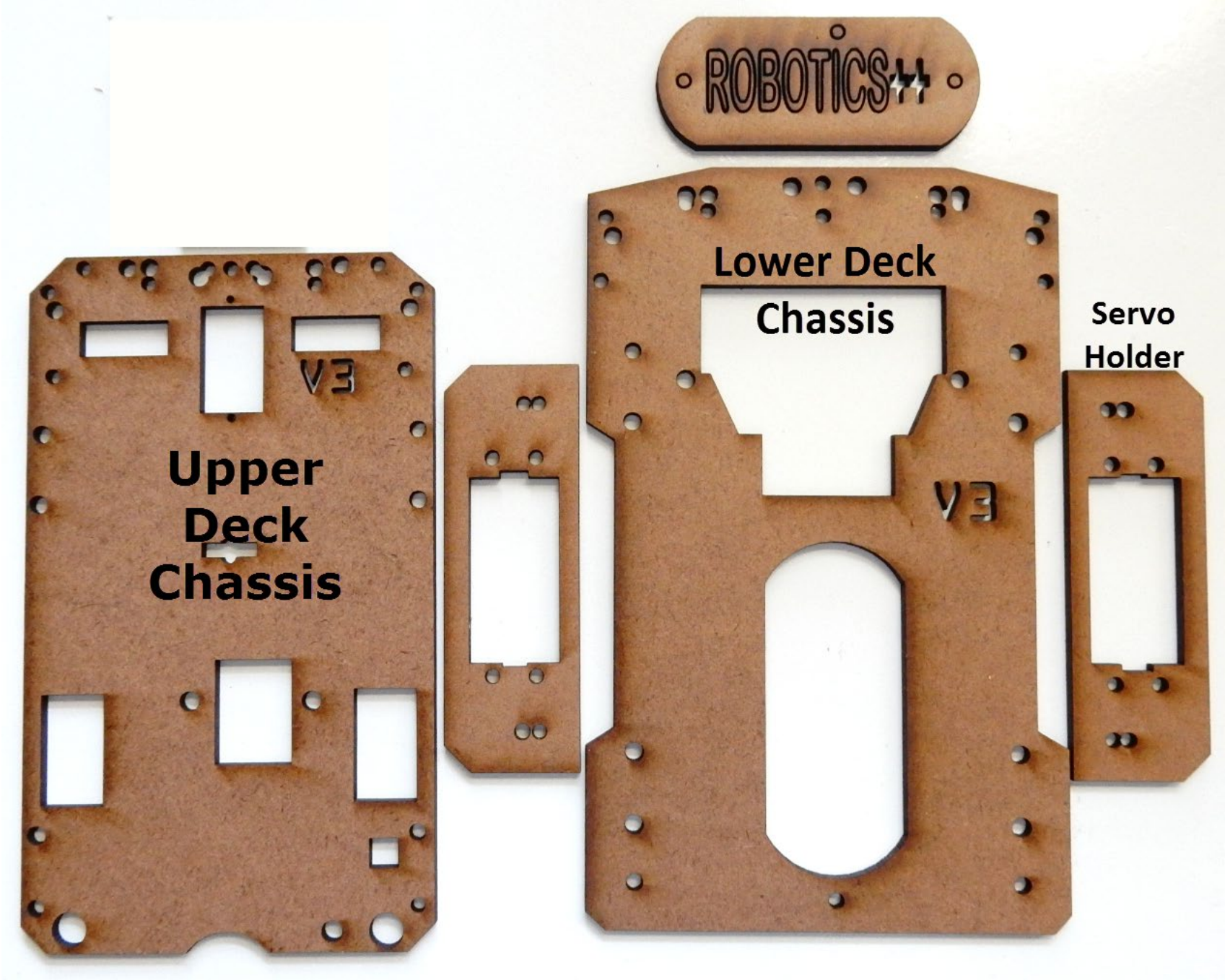


V3 Kit
Parts

Note: Some kits will come with plastic brackets for the wheel servo motor assemblies. Moisture sensor might be red color rather than black as shown here.

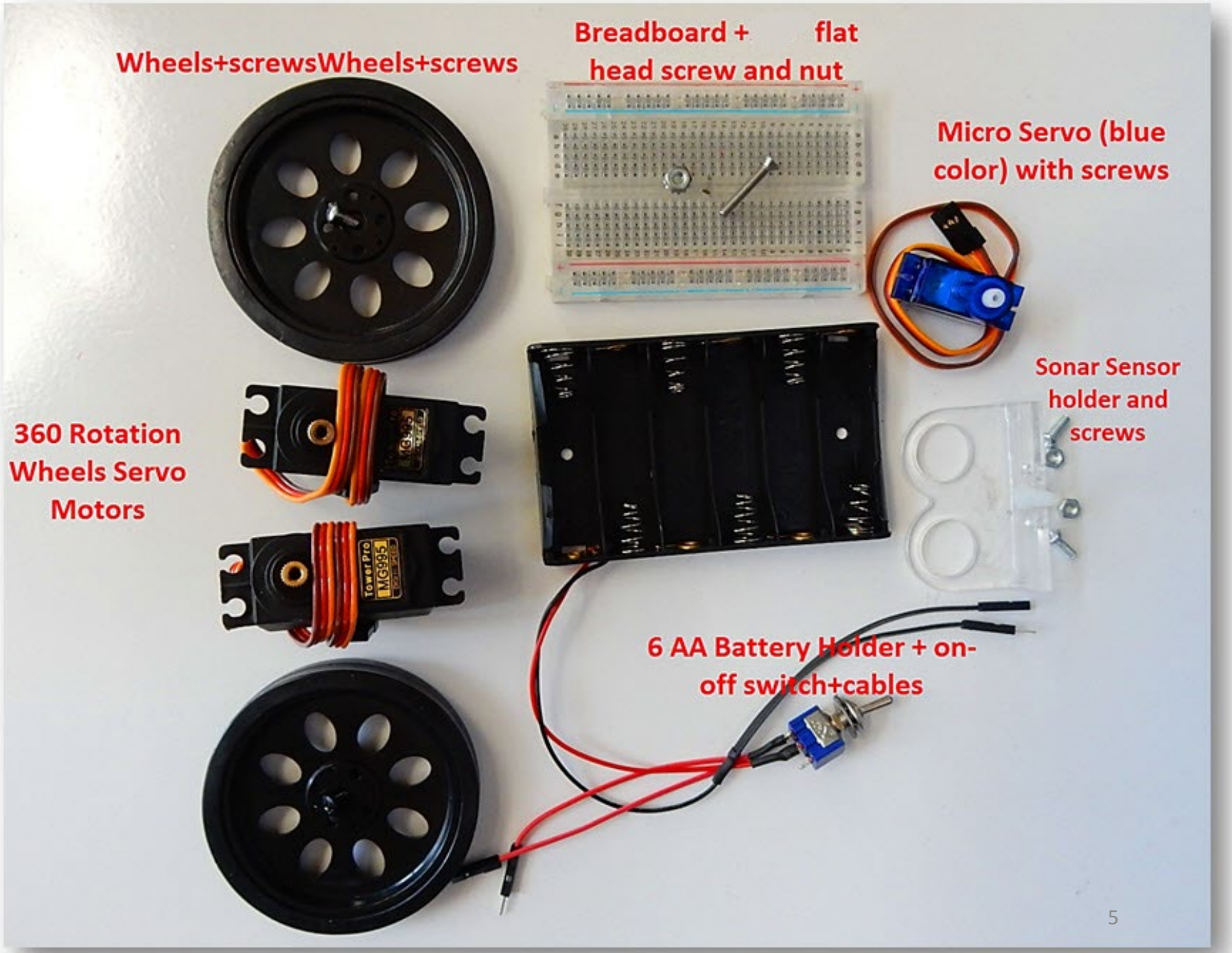


Graphical Parts List

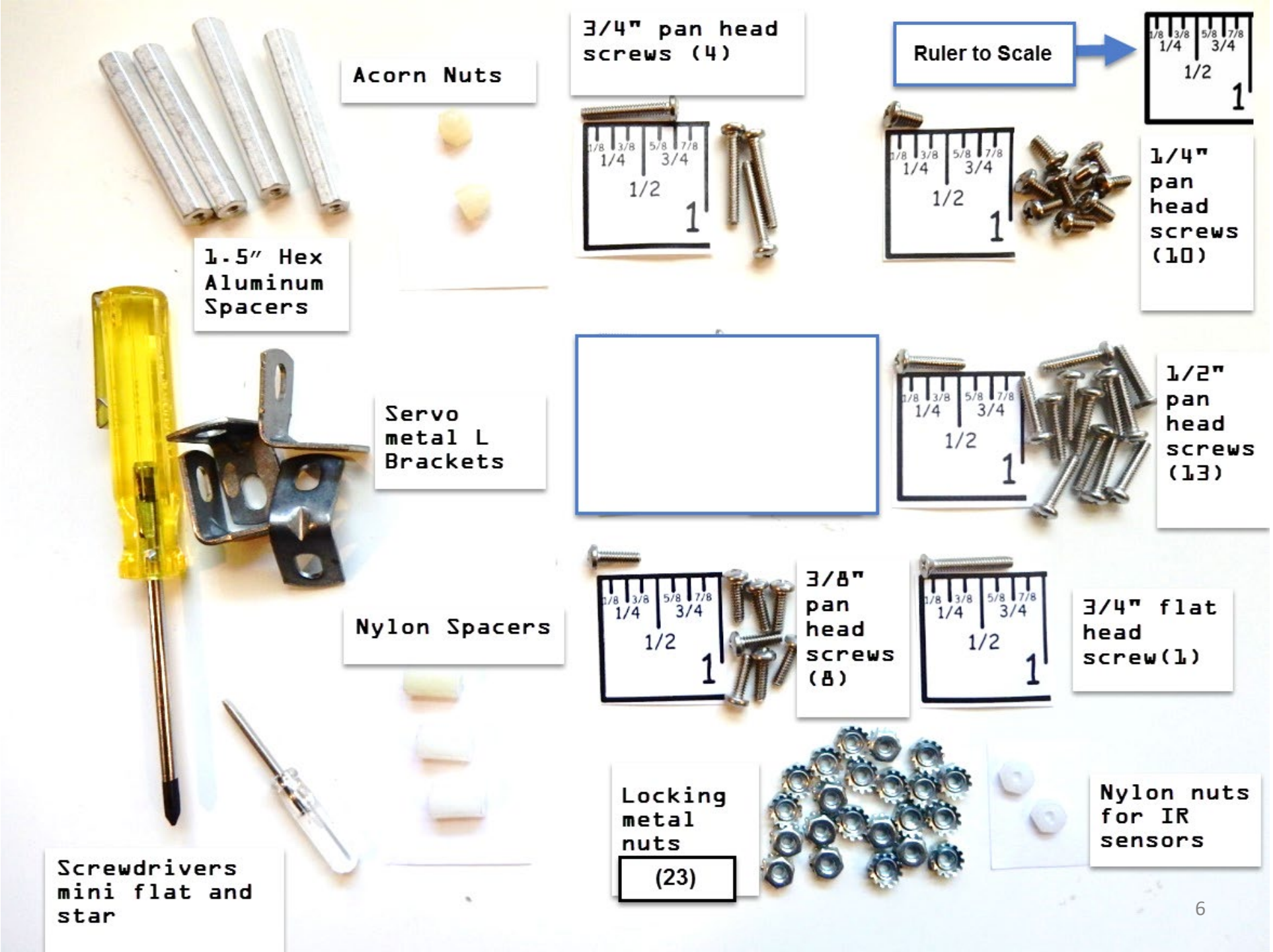


Graphical Parts List

DC-DC 9V to 5V converter



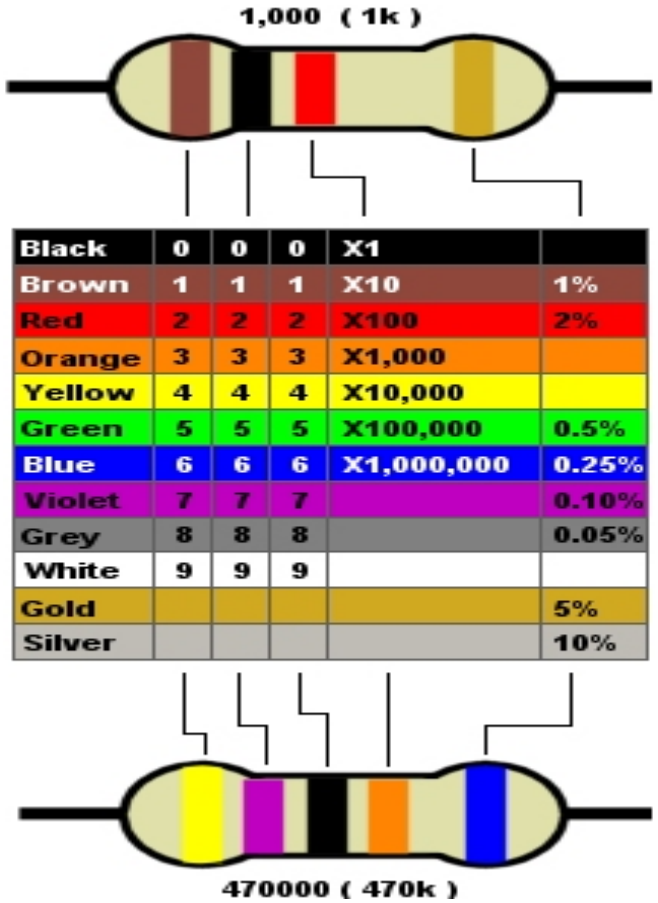
Graphical Parts List



Graphical Parts List
Note: accelerometer is no longer included in kit.

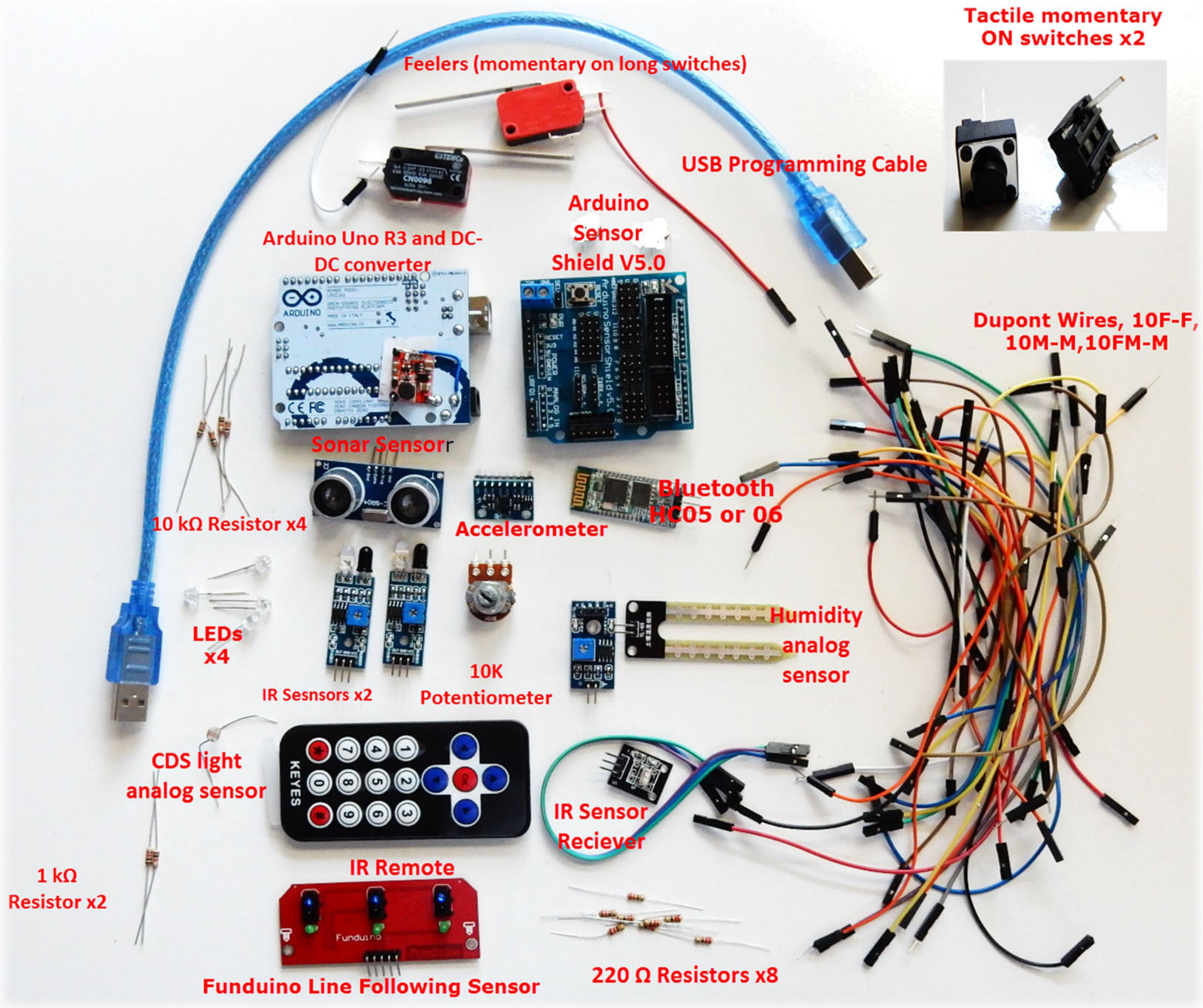
Resistors color code:

220 Ohm – Red, Red, Brown
1K Ohm- Brown, Black, Red
10K Ohm – Brown, Black, Orange



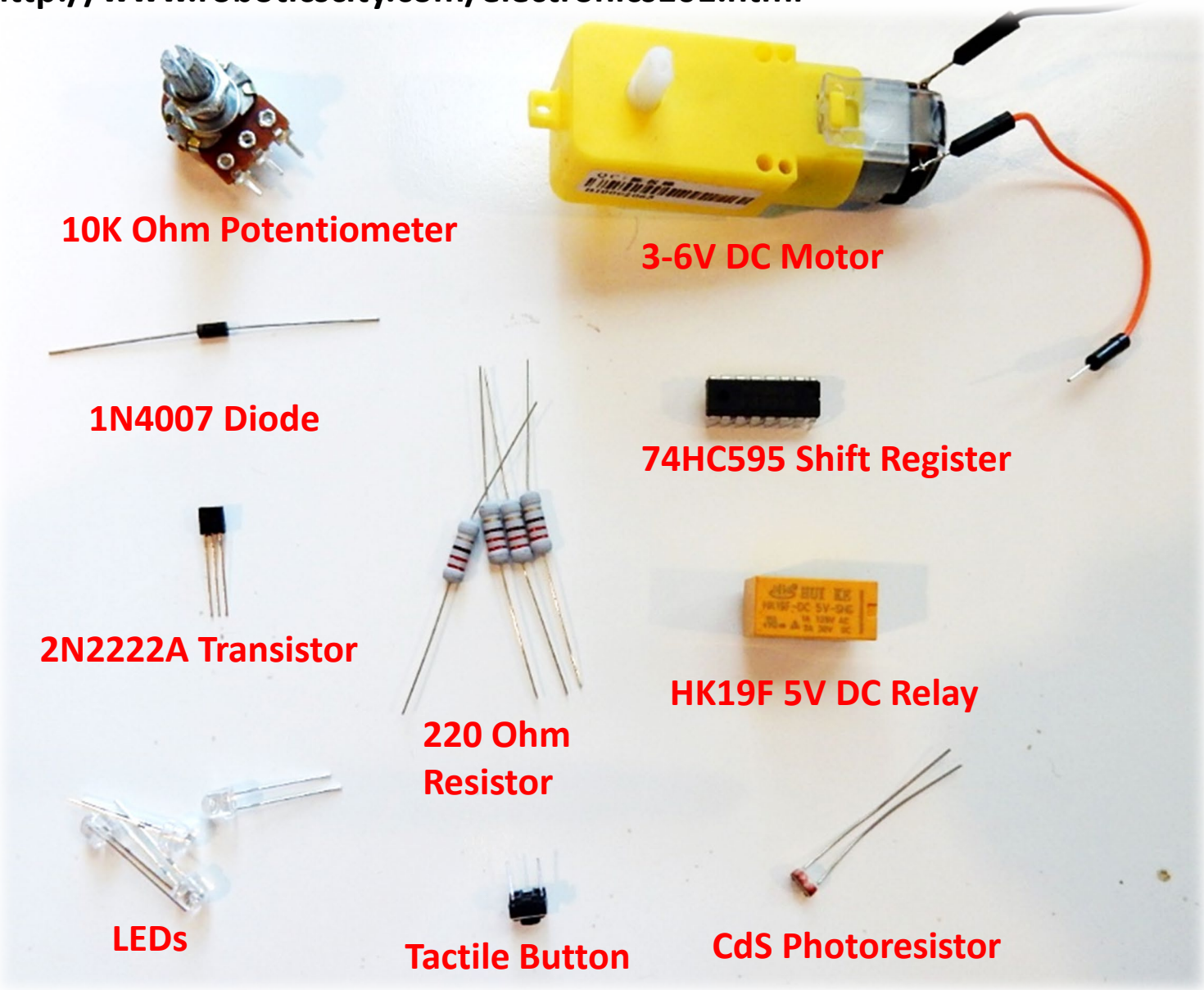
Black	0	0	0	X1	
Brown	1	1	1	X10	1%
Red	2	2	2	X100	2%
Orange	3	3	3	X1,000	
Yellow	4	4	4	X10,000	
Green	5	5	5	X100,000	0.5%
Blue	6	6	6	X1,000,000	0.25%
Violet	7	7	7		0.10%
Grey	8	8	8		0.05%
White	9	9	9		
Gold					5%
Silver					10%

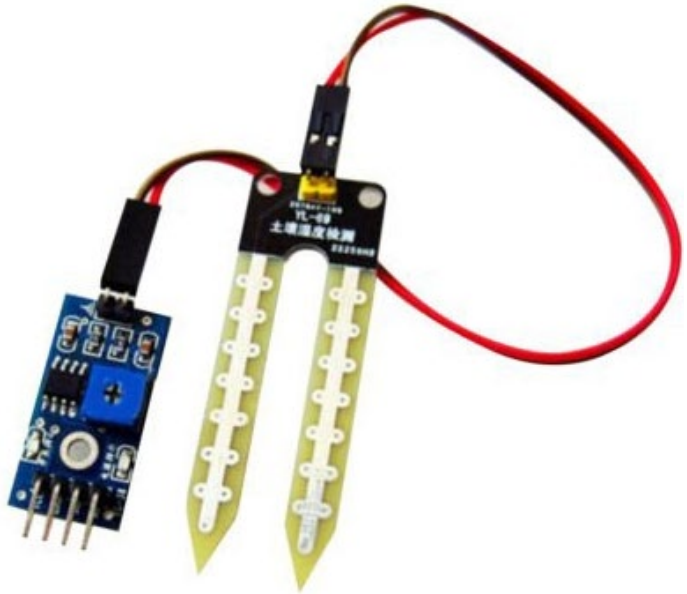
Potentiometer is 10K Ohm

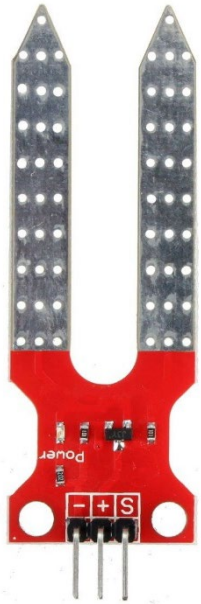


Extra Electronic Components are meant to be used when doing the Electronics 101 – (10 Extra Projects) See link below for instructions http://www.roboticscity.com/electronics101.html

Note: There are two kind of moisture sensors. You will get whichever one we have in stock







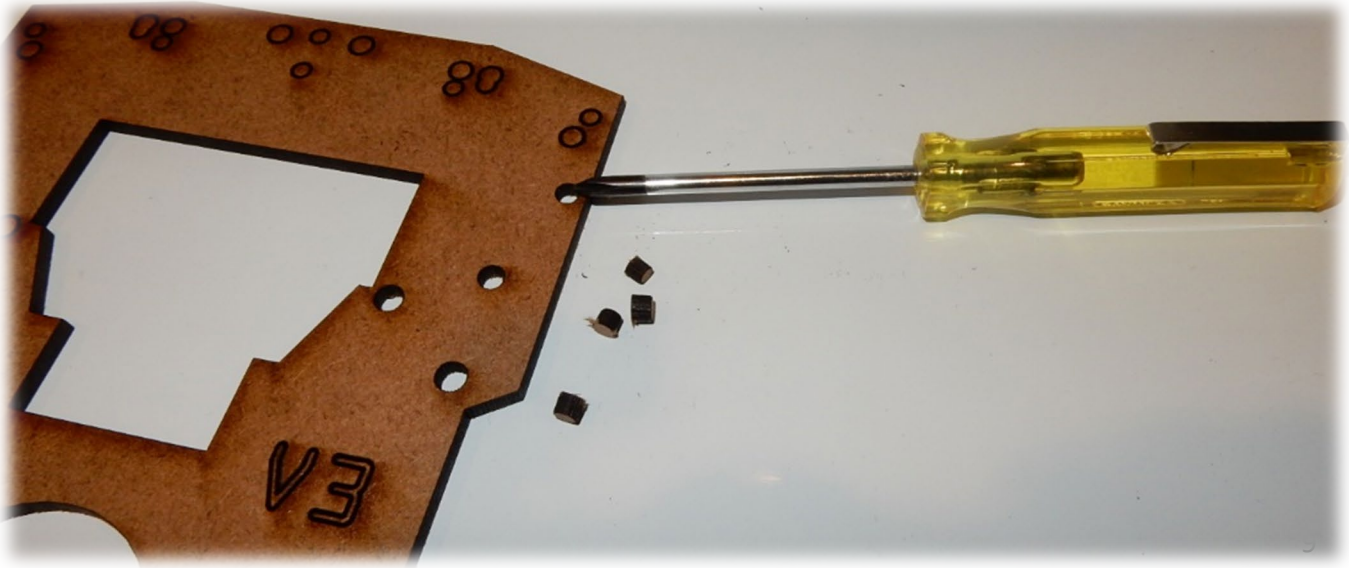
Graphical Parts List

<u>SUMO Parts:</u>

(2) Plastic L brackets

(1) Lasercut ramp

Note: Some laser cut parts will still have remaining chads. Please use your start or mini screwdriver to pop-out the chads as seen on the right.



Step 1: Assembling the Servo Motors

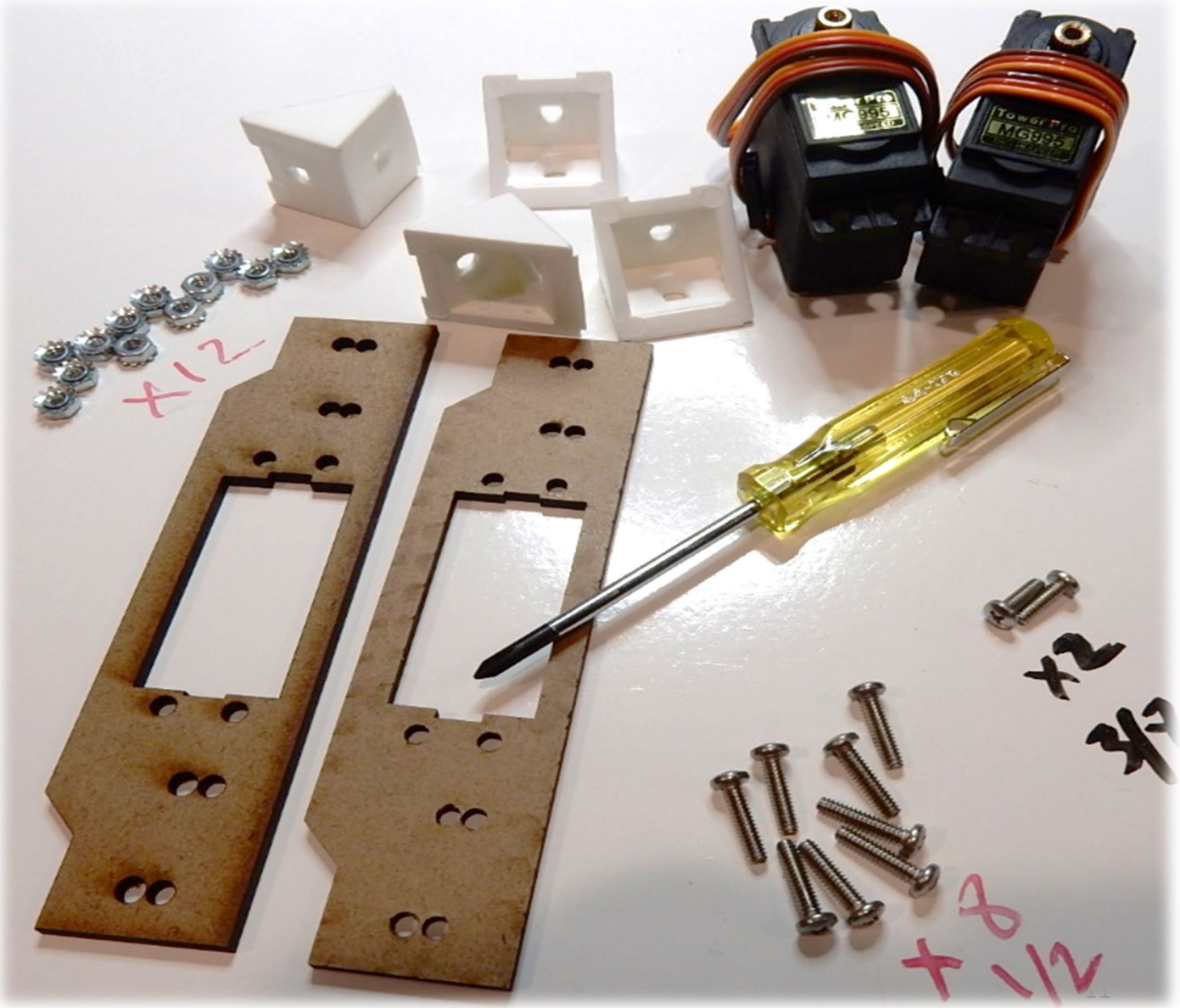
Parts:
(2) Servo motors
(8) 1/2” pan head screws
(8) Lock nuts
screwdriver
(4) Metal or plastic servo holder L brackets
(2) Laser cut servo holders
(1) Screwdriver

Note: You may also refer to the pictorial parts list to learn more about the names of each component

Step 1: Assembling the Servo Motors – for kits with plastic L brackets - Continued

Parts:

(2) Servo motors
(8) 1/2” pan head screws
(8) Lock nuts
screwdriver
(4) plastic servo holder L brackets
(2) Laser cut servo holders
(1) Screwdriver

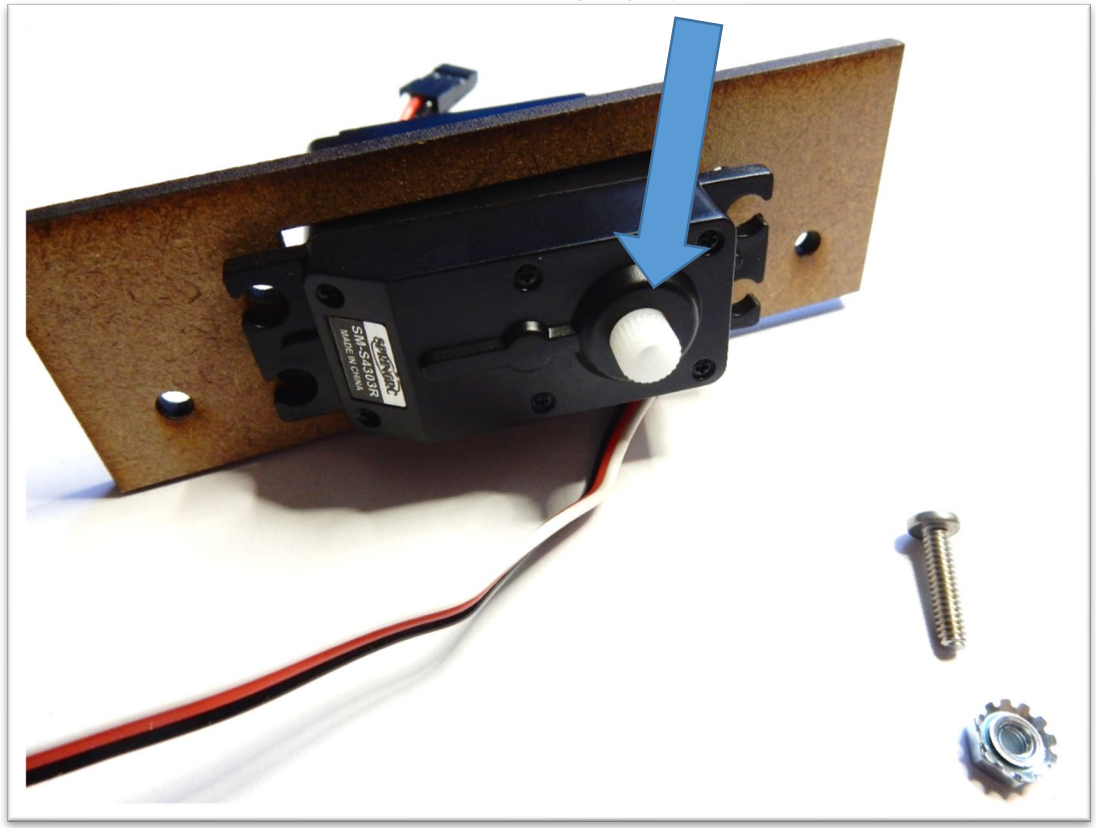


Insert the servo motors into the servo holders and secure them with the 1/2” screws and nuts as shown on the right photo.

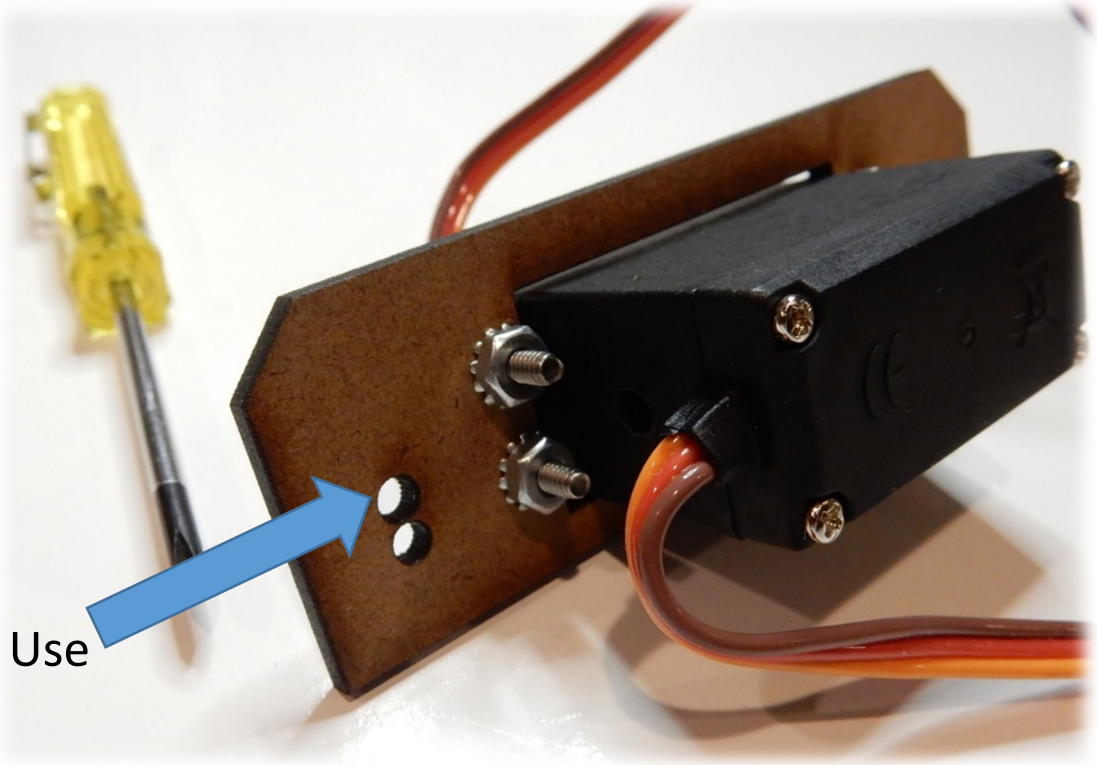
Please take careful note and on the next page:

- how the motors are <u>inserted into the servo holders</u>
- how the screws face in on the servo holders
- how the shaft of the motor is facing on the front on both left and right sides.

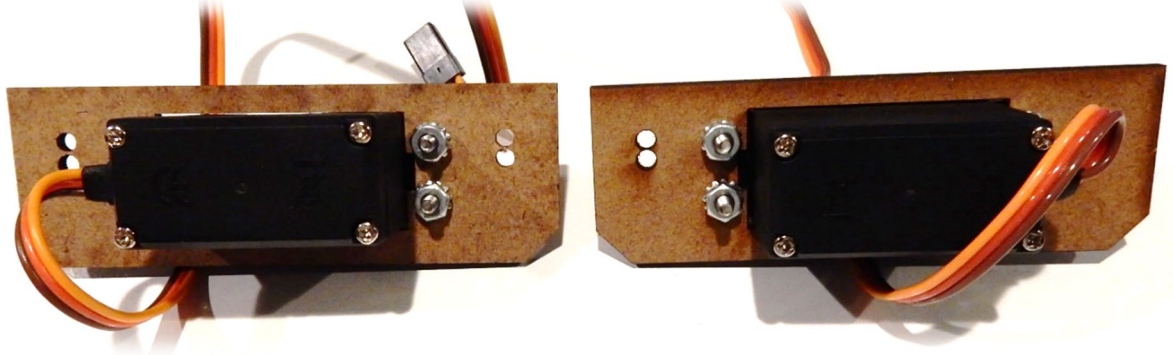
shaft



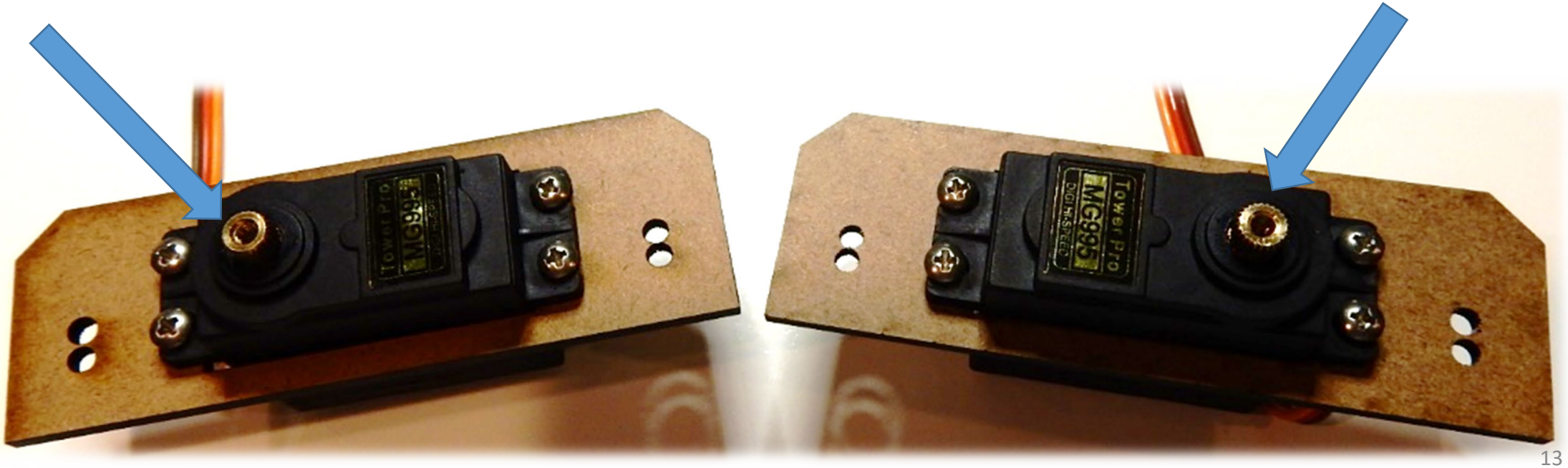
Hole for servo L bracket screw -- Use top or bottom



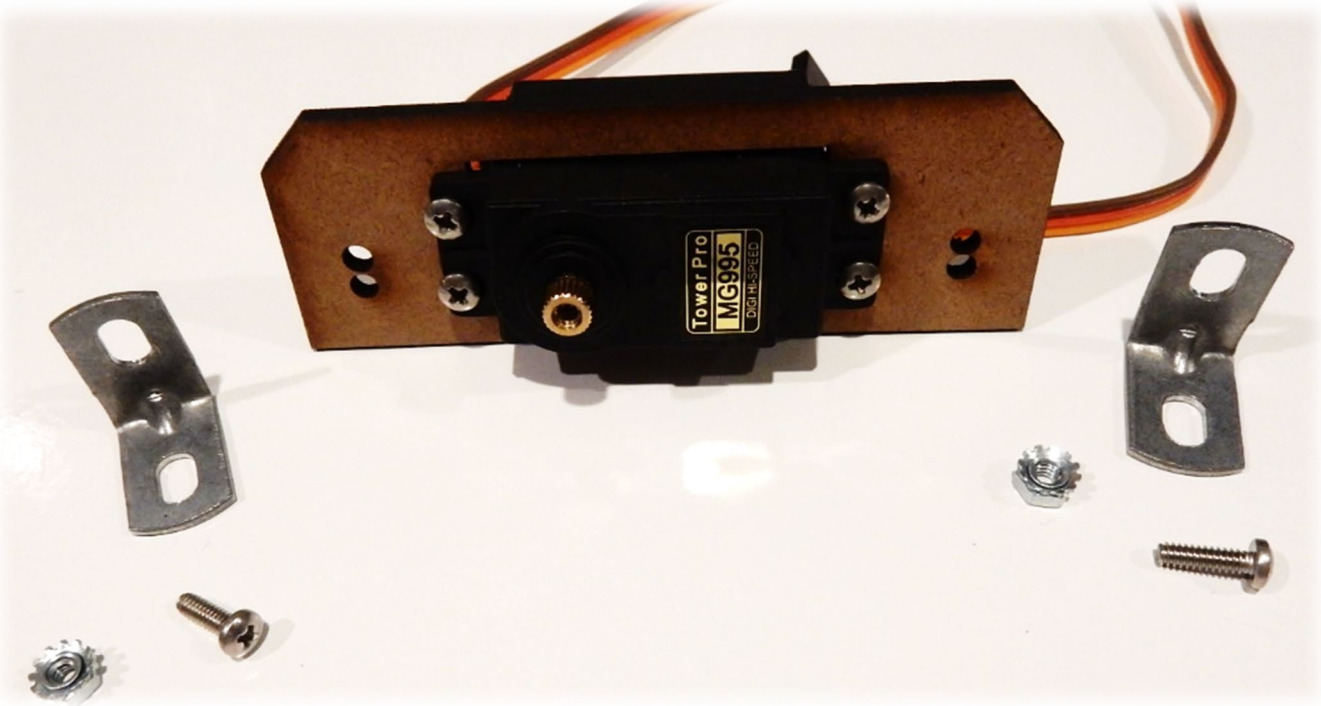
Backside of servo assemblies



Notice how the position of the shaft on each servo holder is on opposite ends. One will be on the left and the other on the right

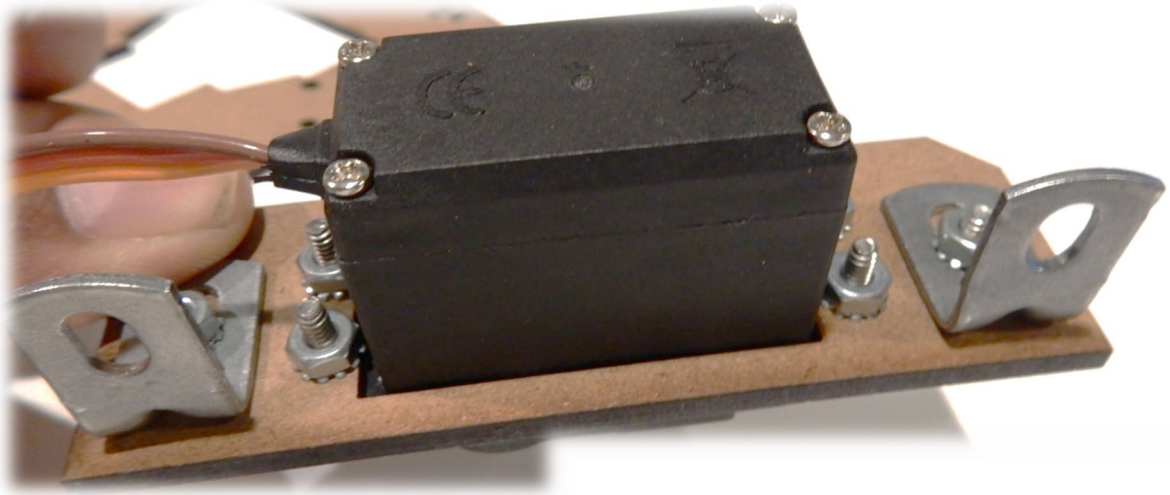


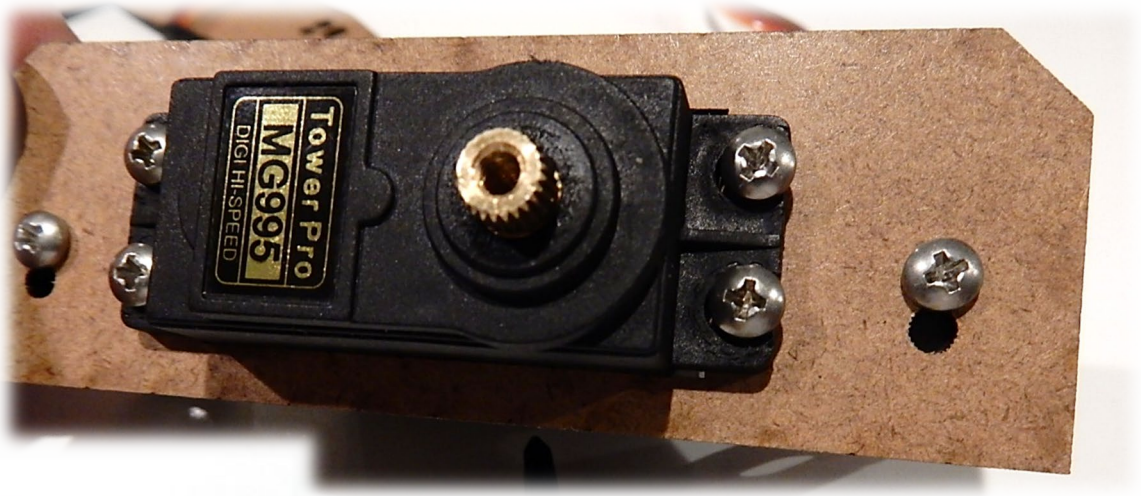
Step 2: Assembling the metal or plastic servo holder L brackets

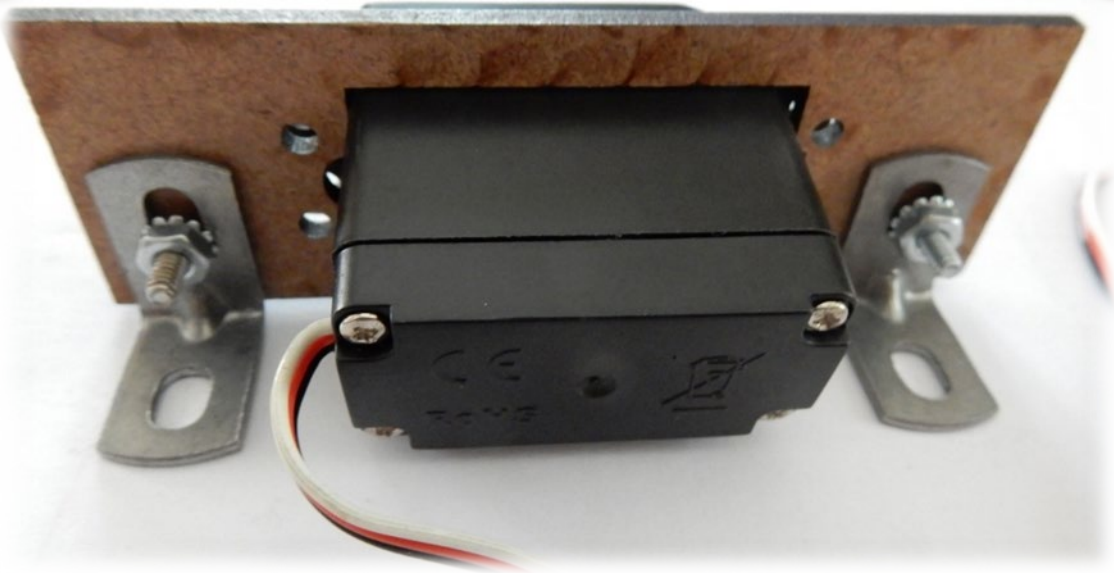


Parts:
(4) metal locking nuts
(4) 3/8 screws
(4) metal or plastic brackets
(1) star screwdriver

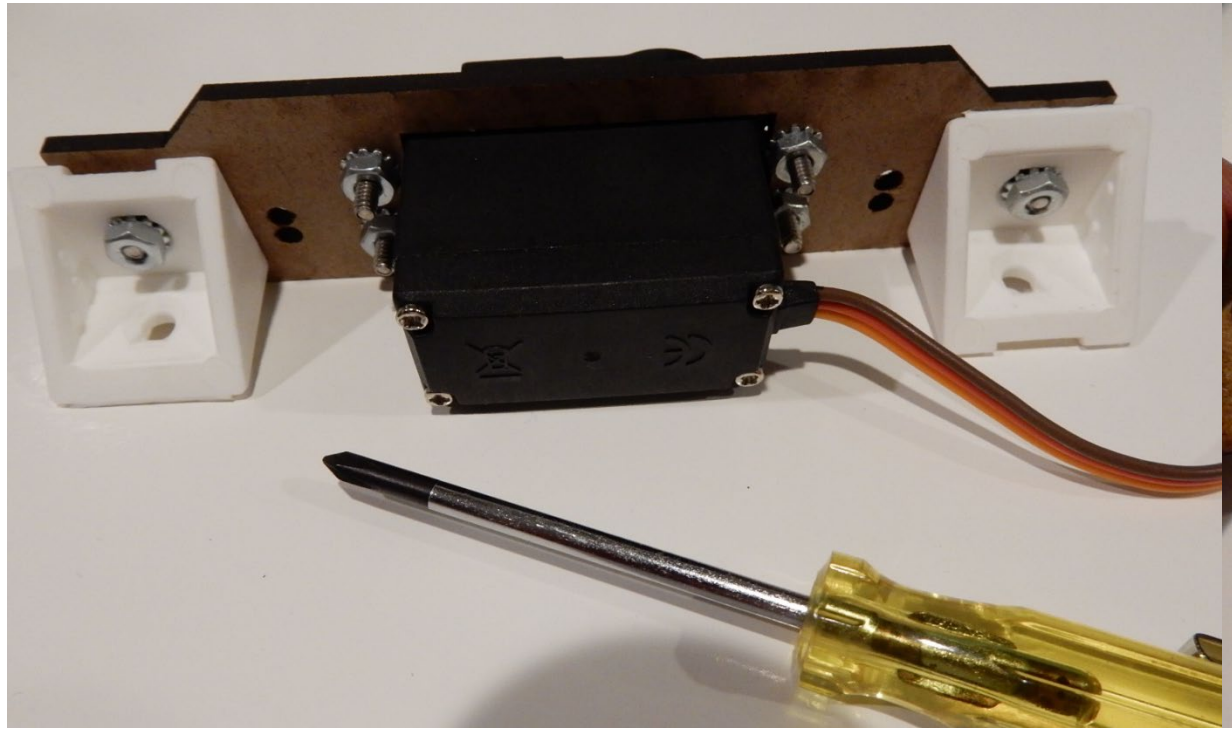
Paying attention to the direction the screw goes in, assemble the metal L brackets as shown below on both servo holders. To align the brackets you can hold the assembly against a flat surface then tighten the screws. **Note:** if you do not raise the L brackets your wheels will be too high and the robot will not move so see photo below for how the metal brackets go.

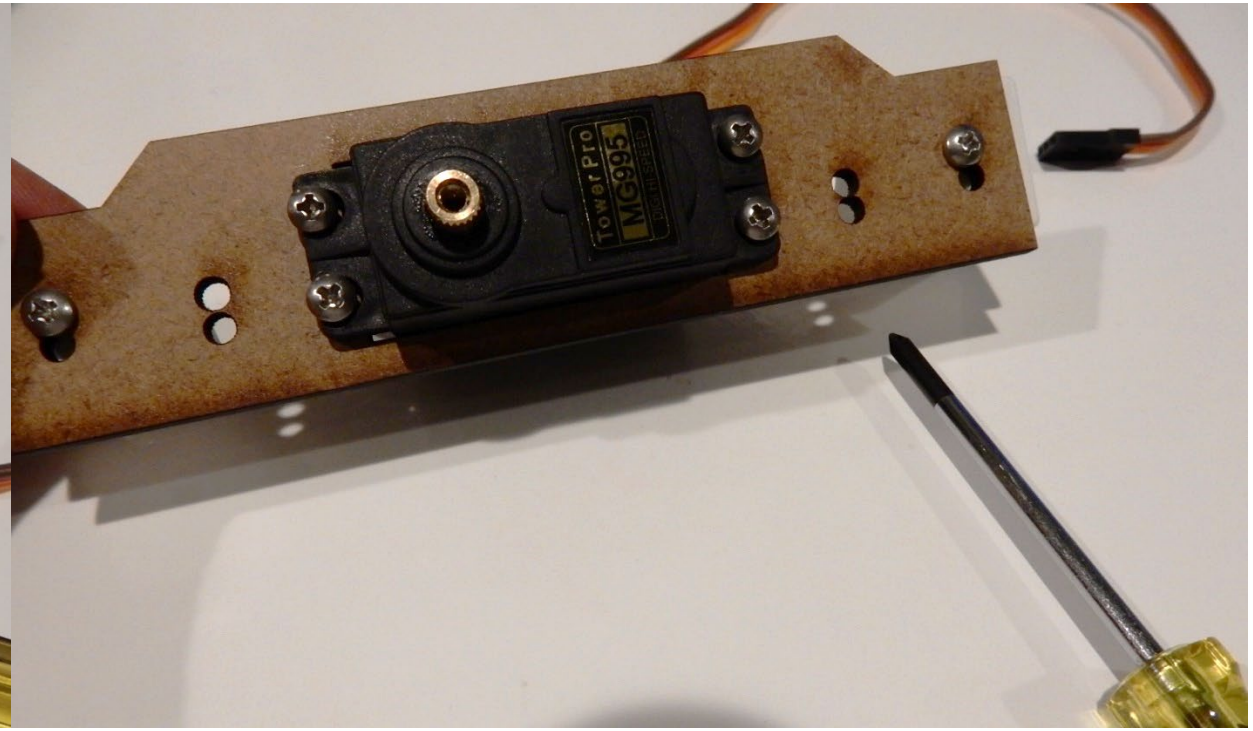






If you have the plastic L brackets be sure to install them on the upper hole as shown below

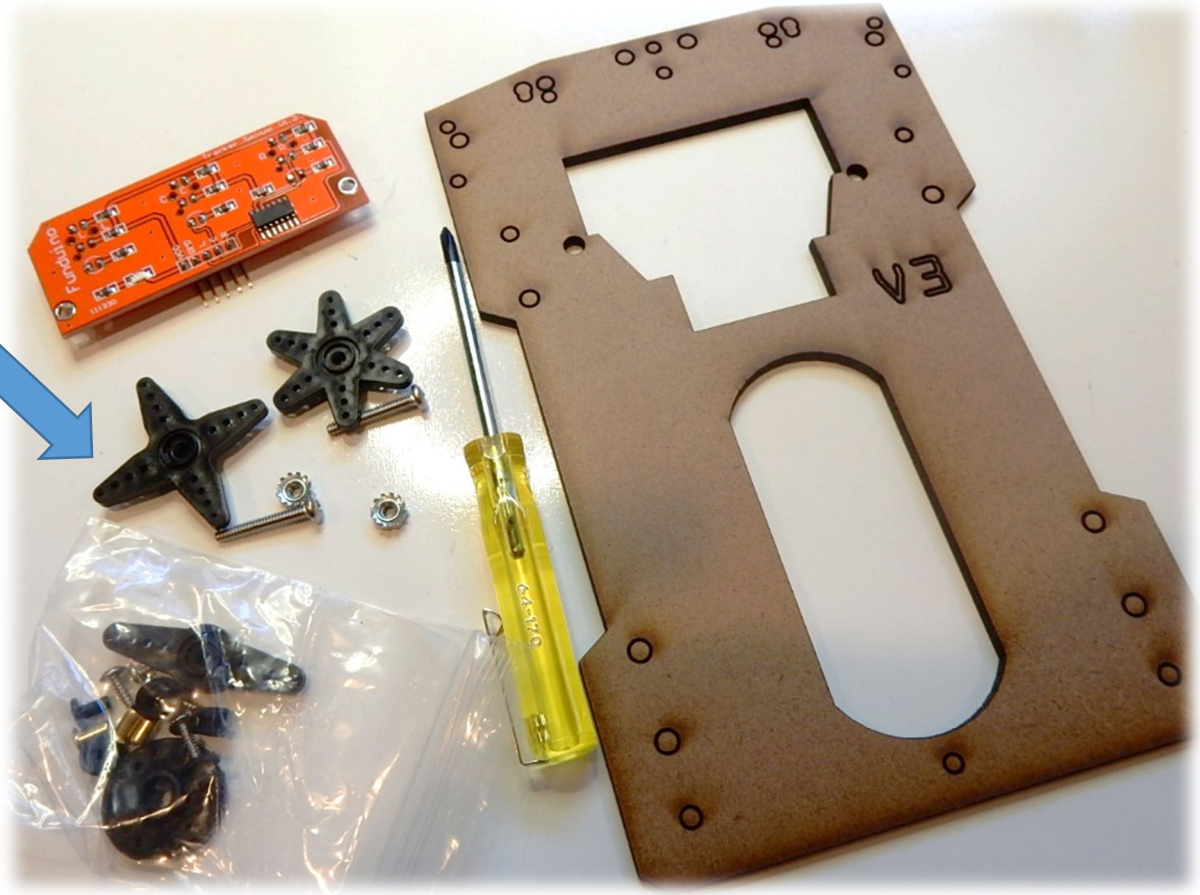




Step 3: Assembling the Line Following Sensor

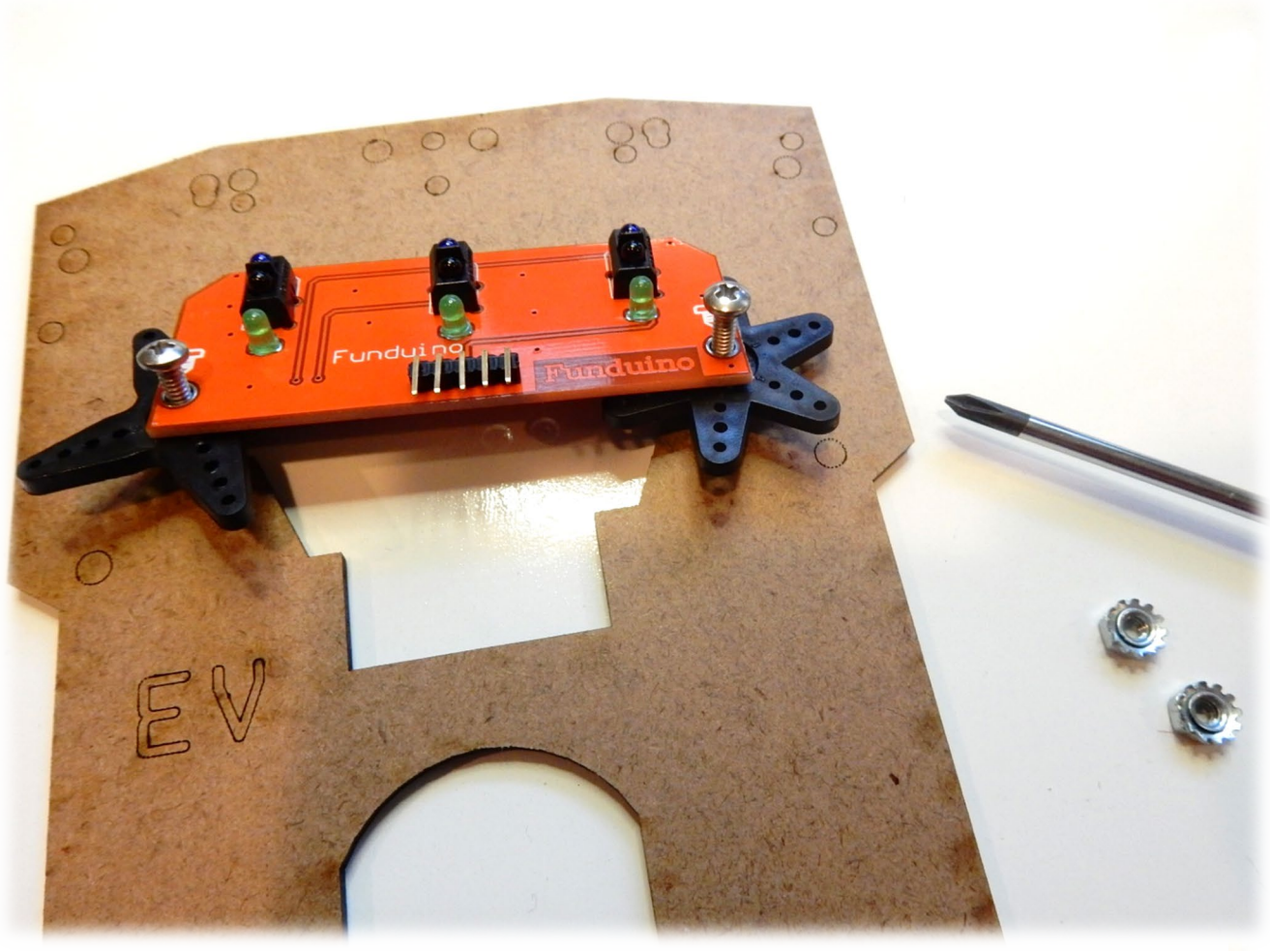
Parts:
(2) metal locking nuts
(2) 3/4 screws
Red line following sensor
Lower laser cut chassis
star screwdriver
Servo horns from one of your 360 rotation servos

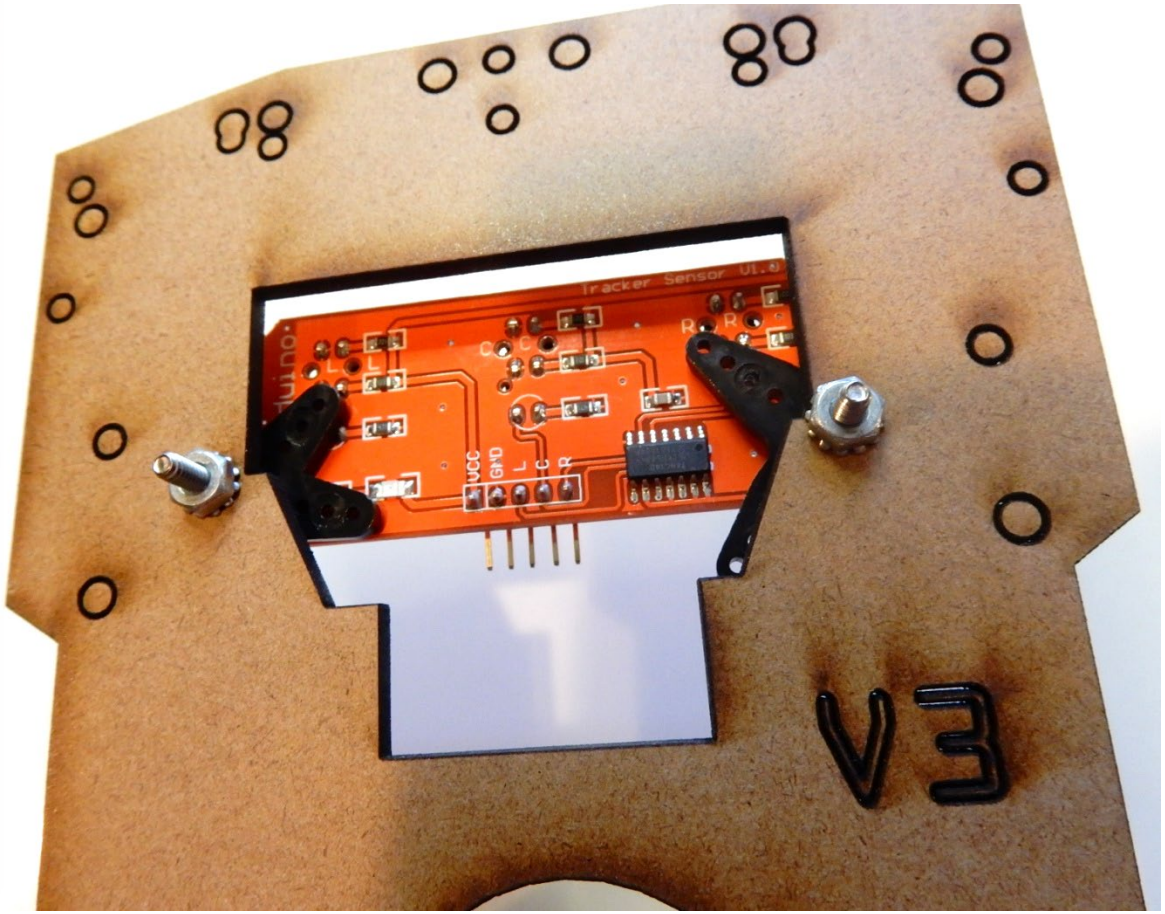
Servo Horns



We will use the plastic servo horns as spacers to ensure the line following sensor is low enough or closer to the floor so it can see the dark/white colors

Follow the photos below to install the sensor using the 3/4” screws. Use the servo motor horns as spacers.





Installing front acorn nut

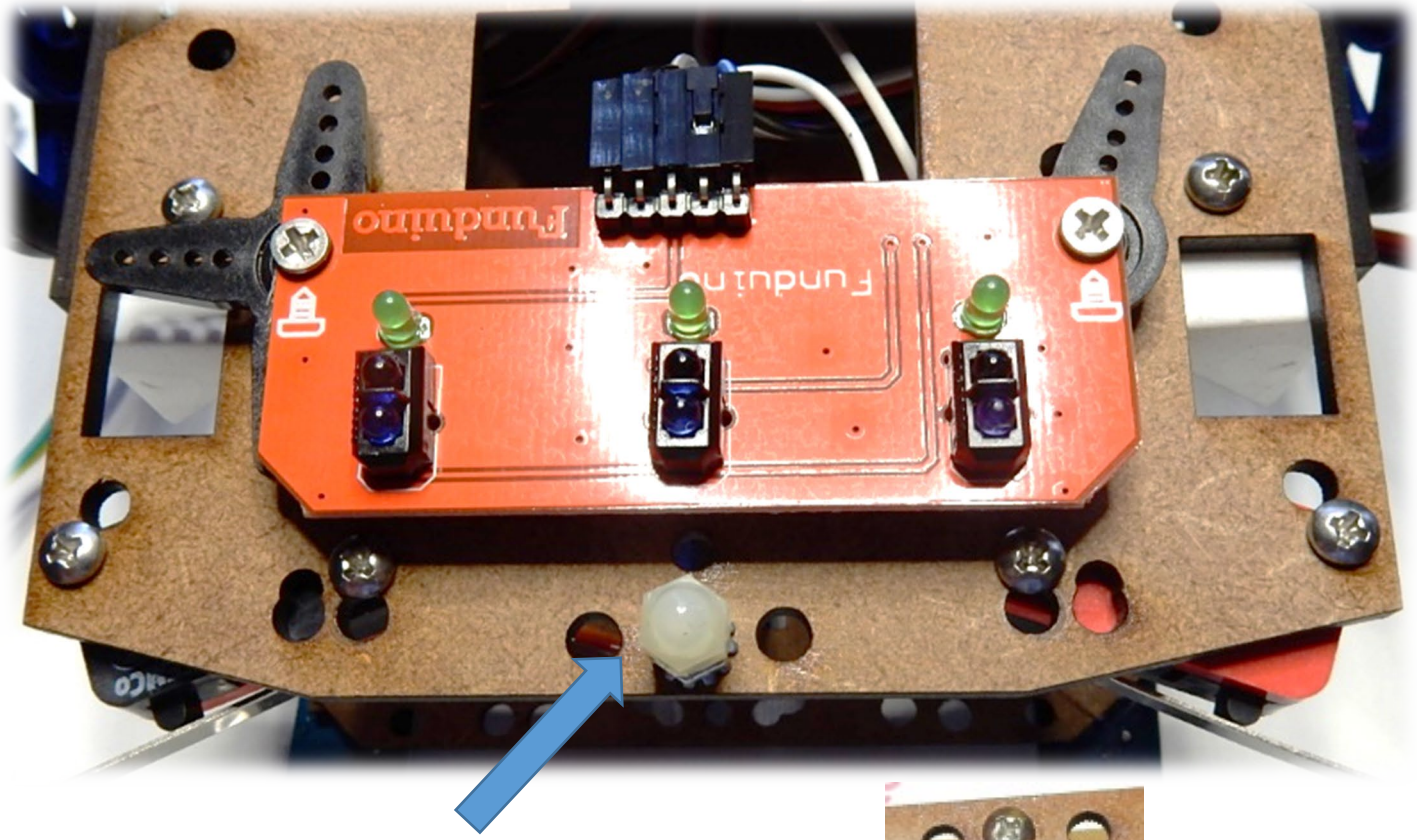
Using a 1/2” pan head screw and lock nut proceed to install as shown below.

Note:

- Try to tighten the acorn nut as much as possible

Parts:

- (1) 1/2” pan head screw
- (1) lock nut
- (1) acorn nut



Acorn nut with ½” Screw

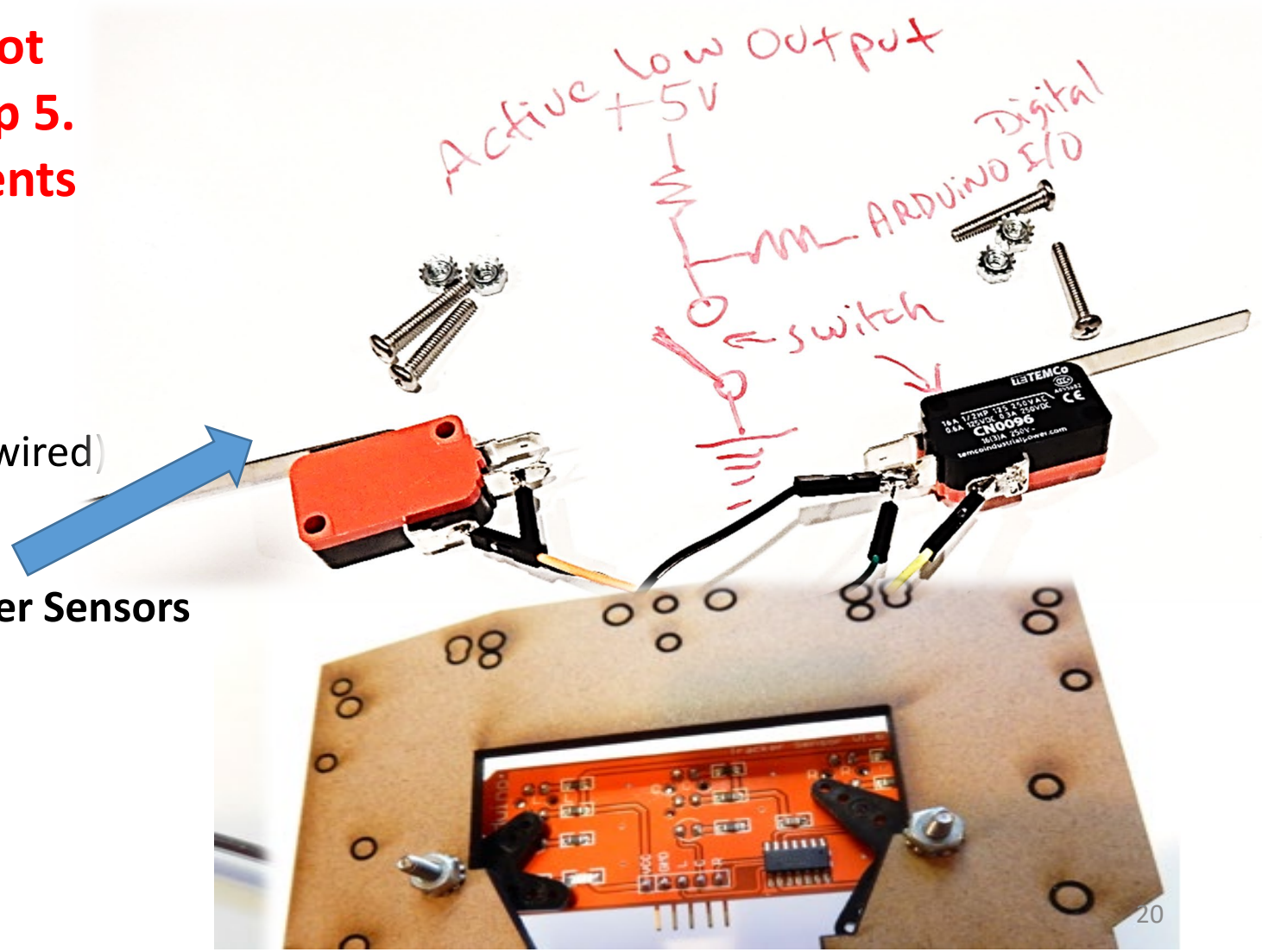
Step 4: Assembling the “Feeler” (switches) Sensors

The feeler sensors are mechanical momentarily ON switches that when pressed it completes the circuit and can trigger a response. These are secondary sensors in case our other sensors do not work.

Note: If you are building the Sumobot (Experiment 8) first then skip to Step 5. The switches are for other experiments

Parts:

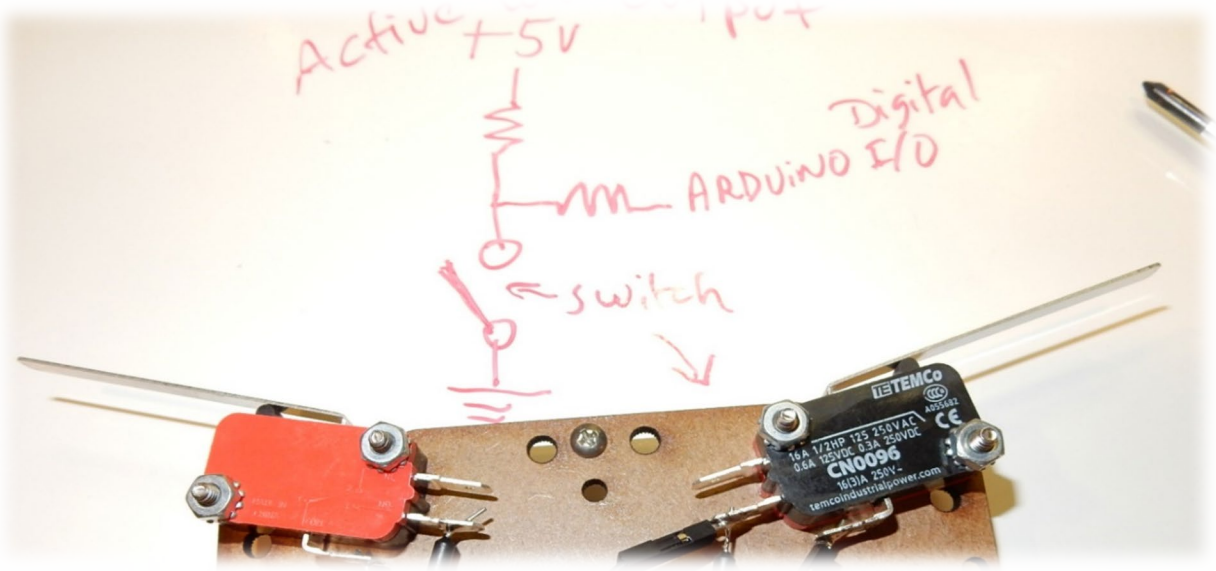
- (4) 3/4” flat head screws
- (4) lock nuts
- (2) Feelers momentarily ON switches (prewired)
- Star screwdriver
- (1) Lower chassis

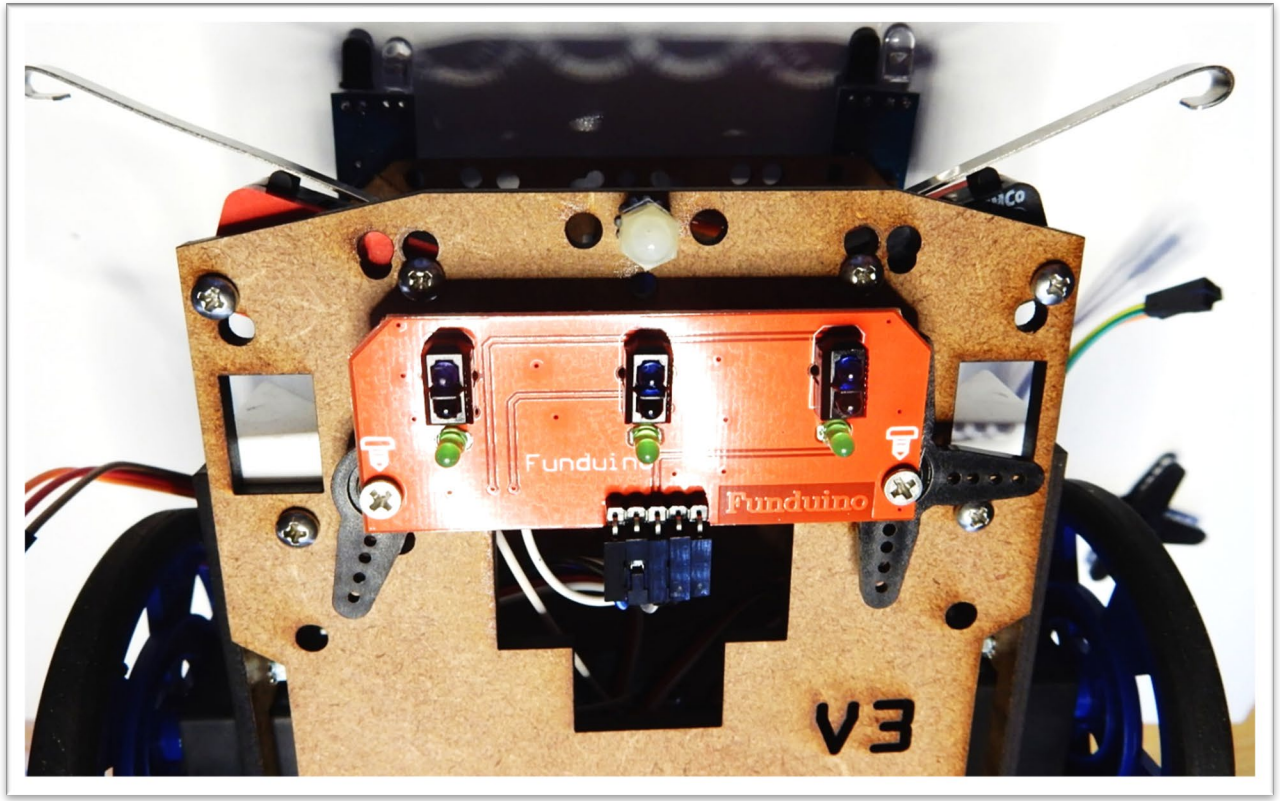


Feeler Sensors

Screw switches as shown using the 3/4” pan head screws

Pay attention to the angles the switches are positioned at



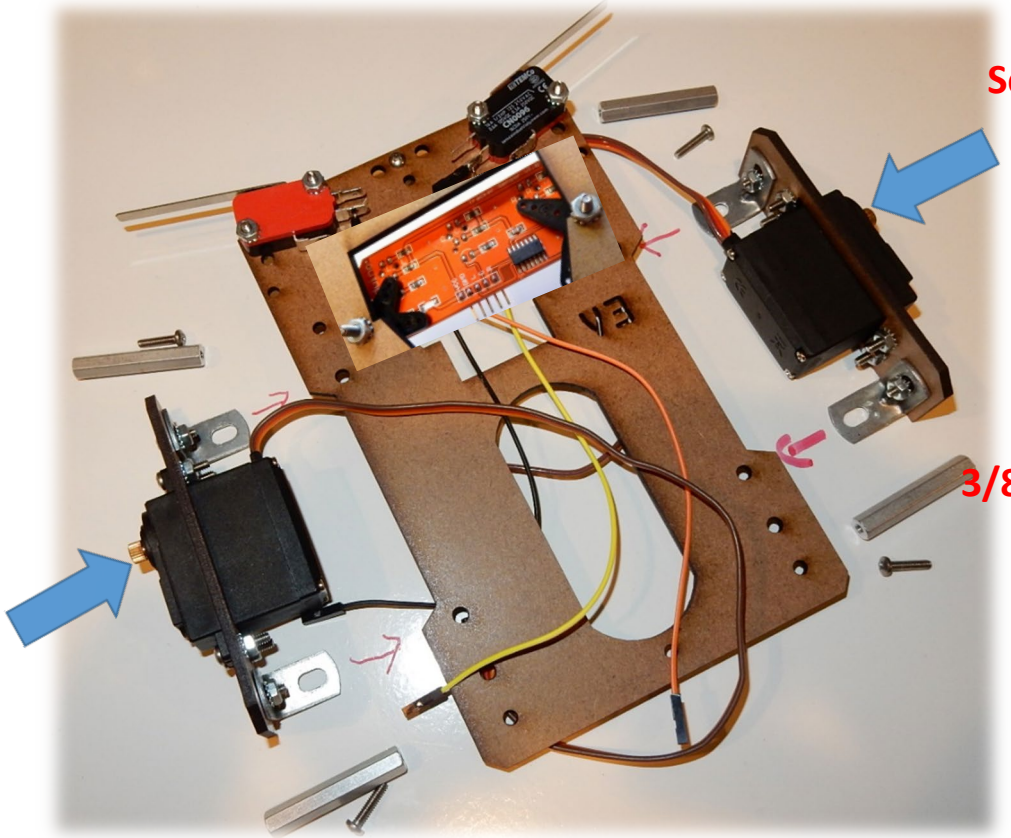


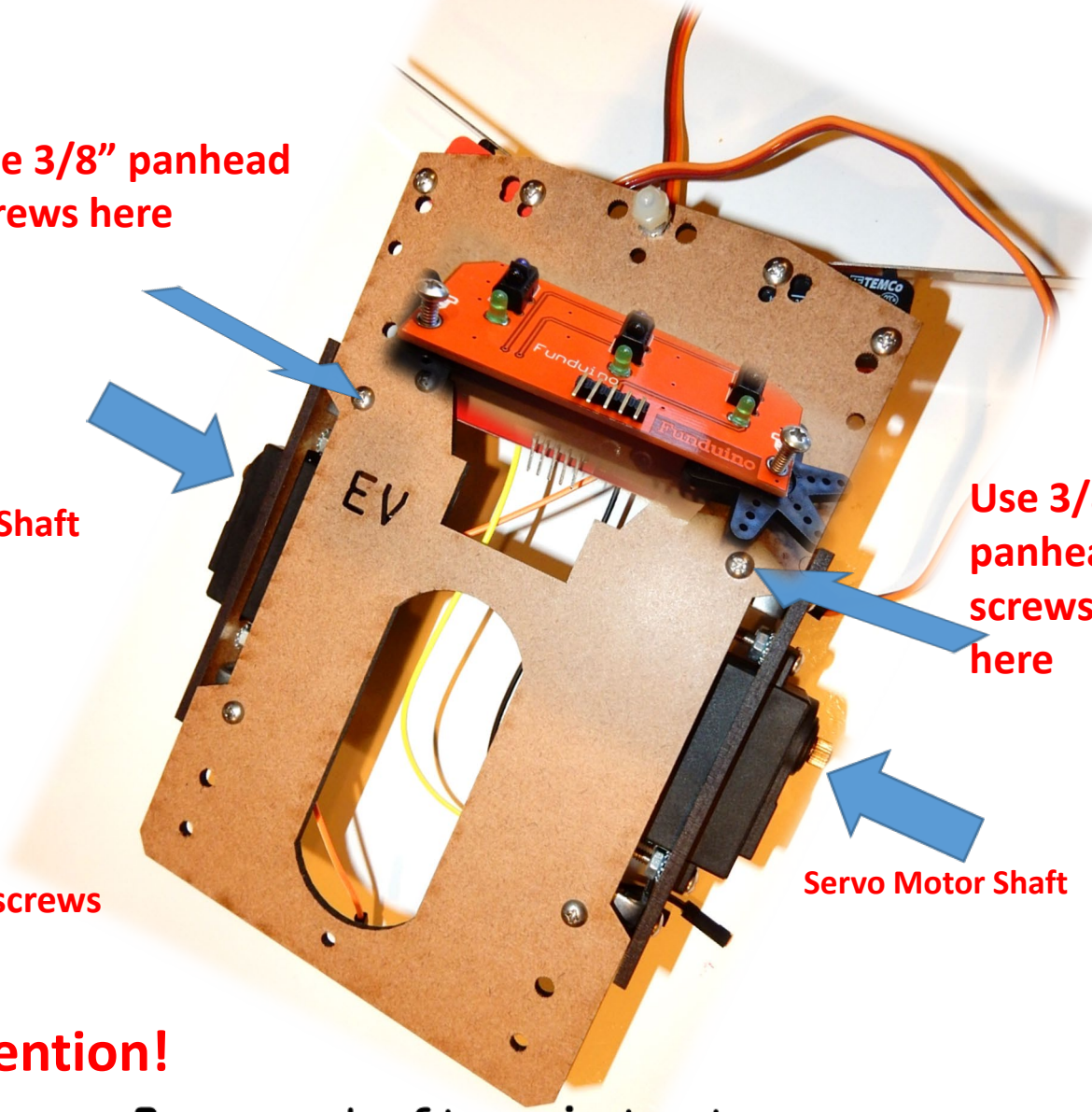
Step 5: Assembling the servo motors on lower chassis

Parts:

- (2) servo assemblies
- assembled lower chassis
- (4) 3/8 inch pan head screws
- Star screwdriver

Note: Go to next page to see how to mount metal spacers





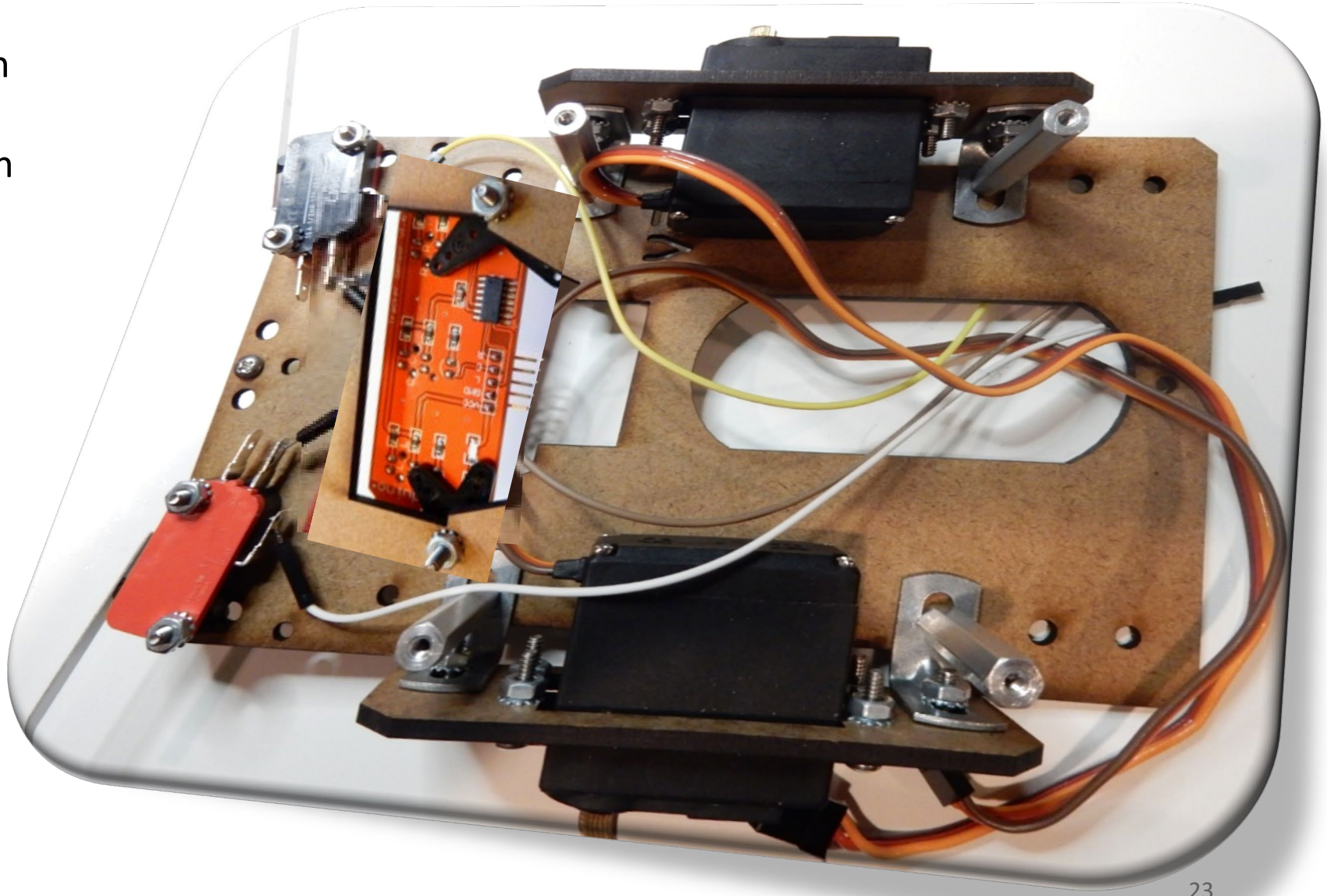
Attention!

Servo shaft points to the front of the chassis

Metal spacers assembled lower chassis

Install servo assemblies as shown on the top side of the lower chassis using the L brackets and the 3/8 inch screws.

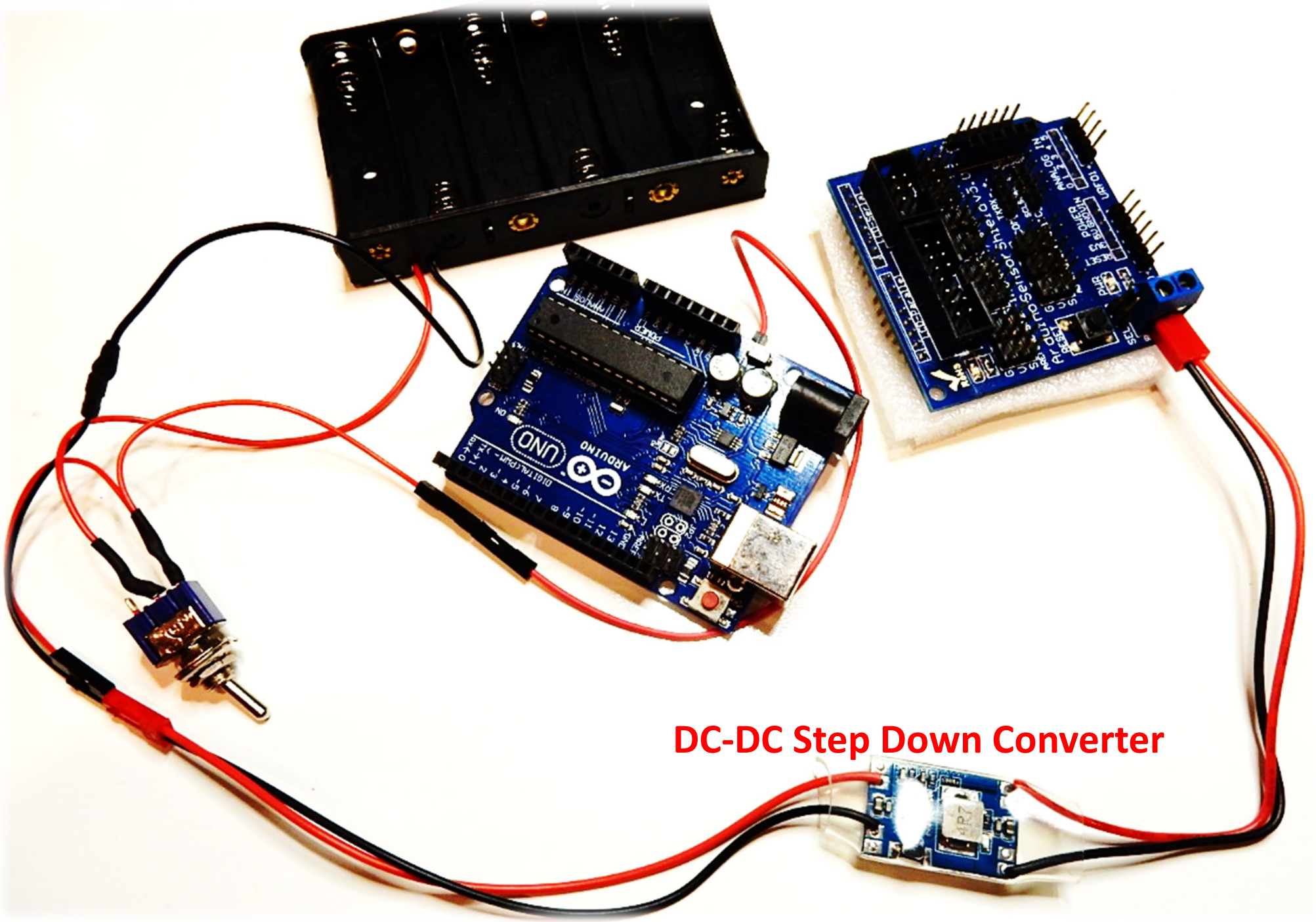
Attention! don't make it too tight yet as you need to assemble the upper chassis on top and might require some alignment adjustments.
Make sure servo shaft points to the front of chassis



Arduino, Battery Holder and Sensor Shield Connections

Make sure you connect your components as shown here

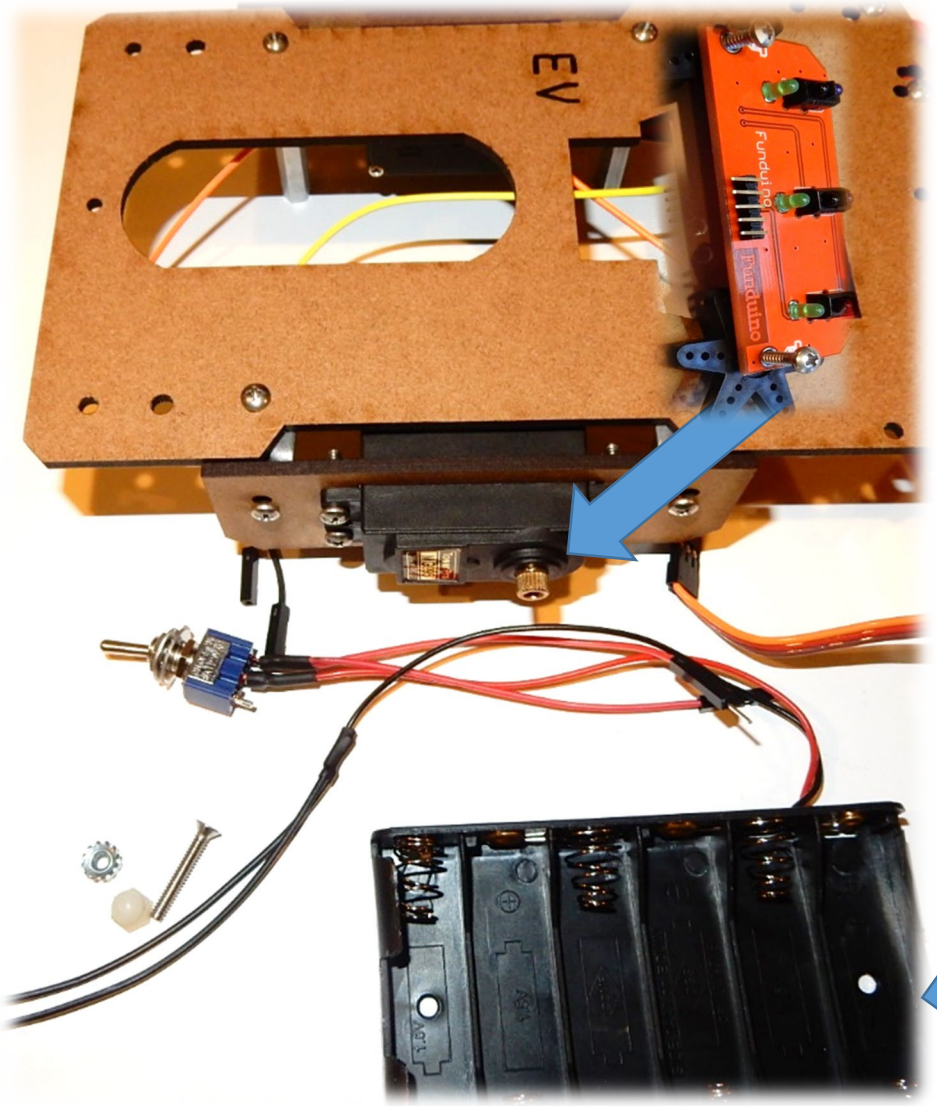
The Arduino board has a DC-DC step up converter to stablelize its voltage while under load or moving the robot. There is also a DC-DC step down converter to convert from 9V to 5V that powers the row of pins where motors will be connected to.



Start preparing the parts to mount the battery holder with ON-OFF switch

Parts:

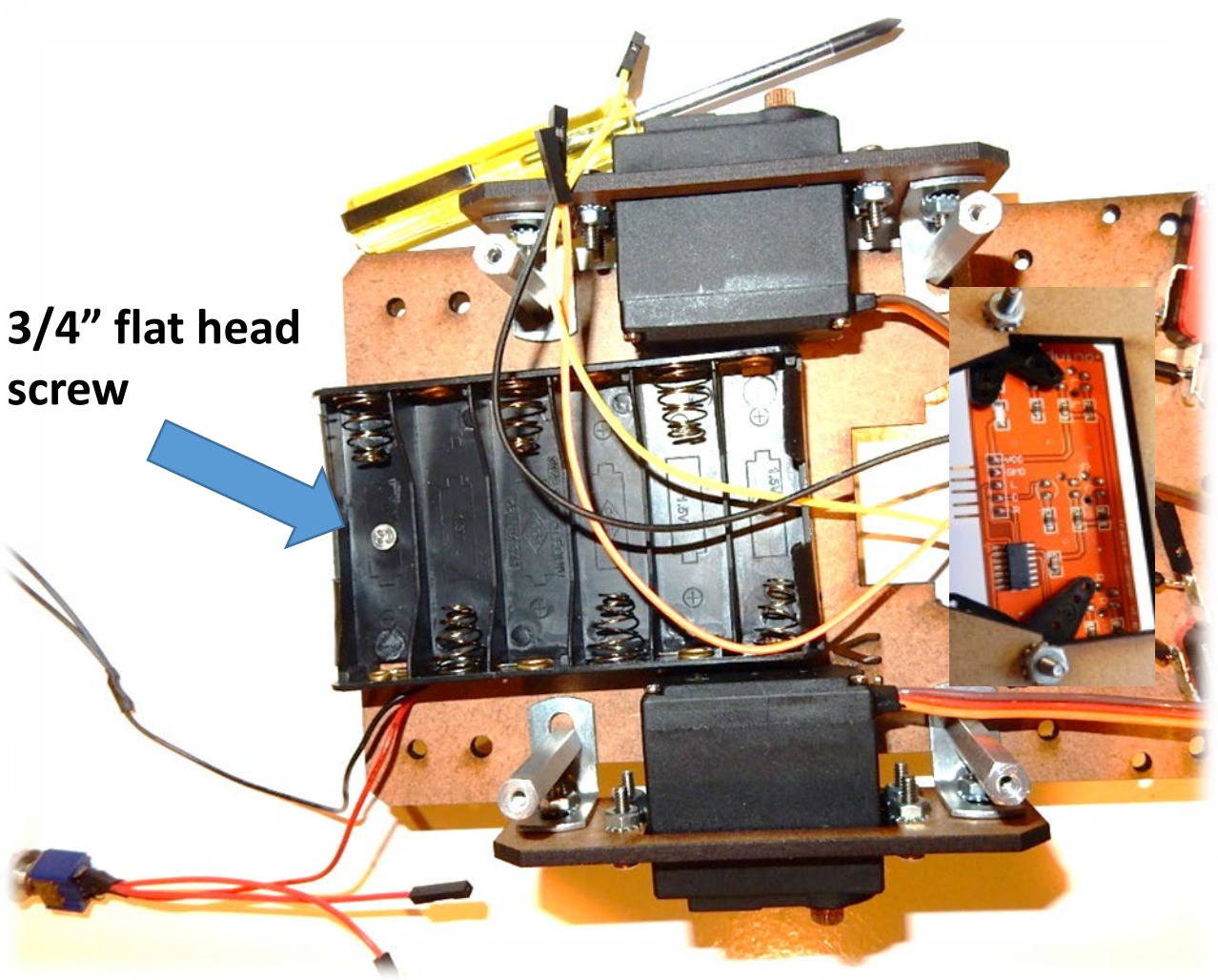
- Battery holder
- (1) 3/4” flat head screw
- (1) acorn nut
- Lower chassis assembly
- (1) lock nut
- Star screwdriver



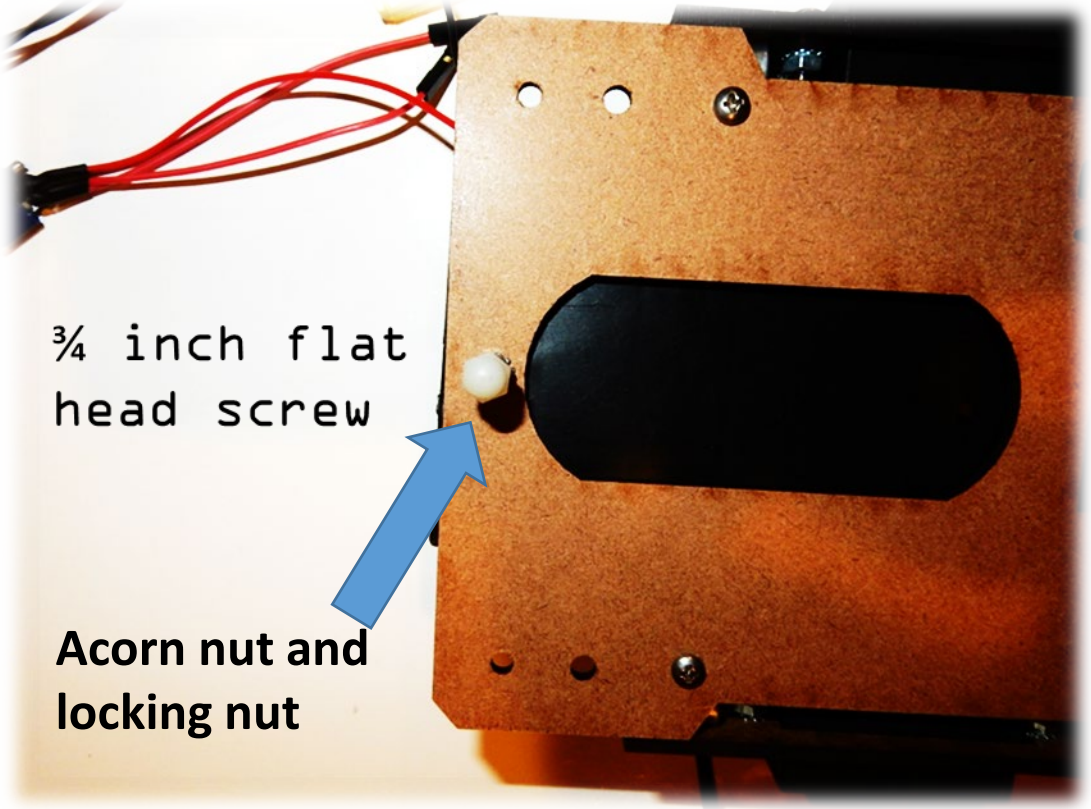
Servo shaft points to front of the chassis

Battery holder with ON-OFF switch. We will install batteries later

Step 6: Assembling the battery holder and back acorn nut



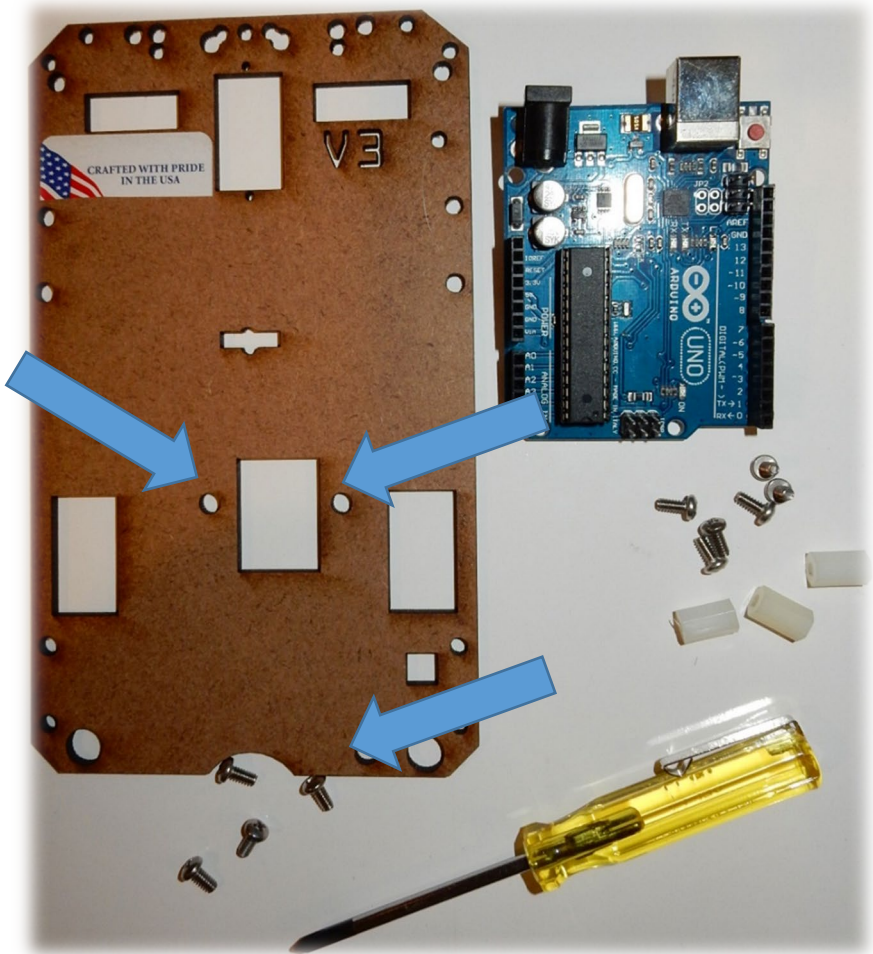
Note: You only will install one screw on the battery holder on the back. You only need one to make it easier to pull out the battery holder and replace batteries when need it



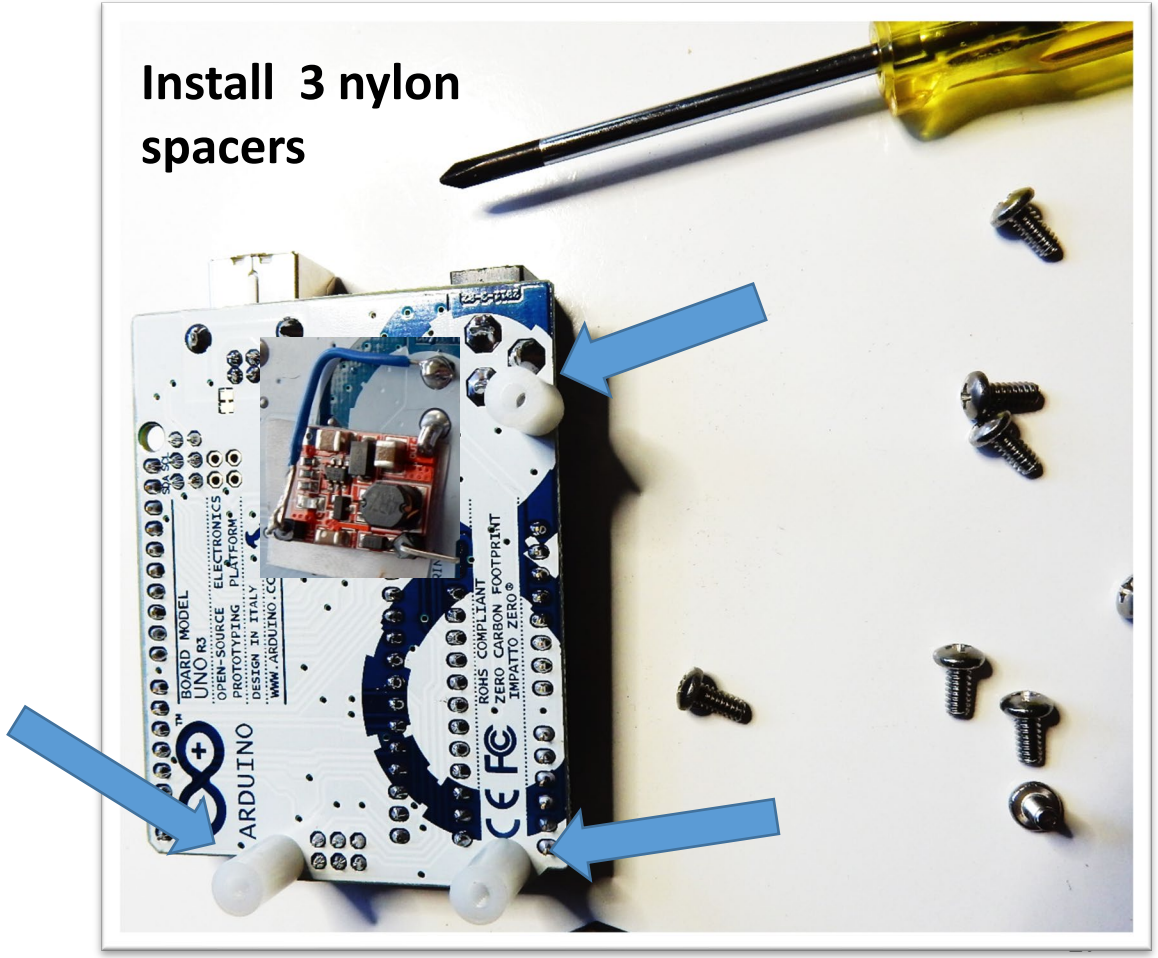
Step 7: Assembling the upper chassis and Arduino board

Parts:

- Upper chassis
- (3) nylon spacers
- (6) 1/4” screws
- Arduino board
- Star screwdriver

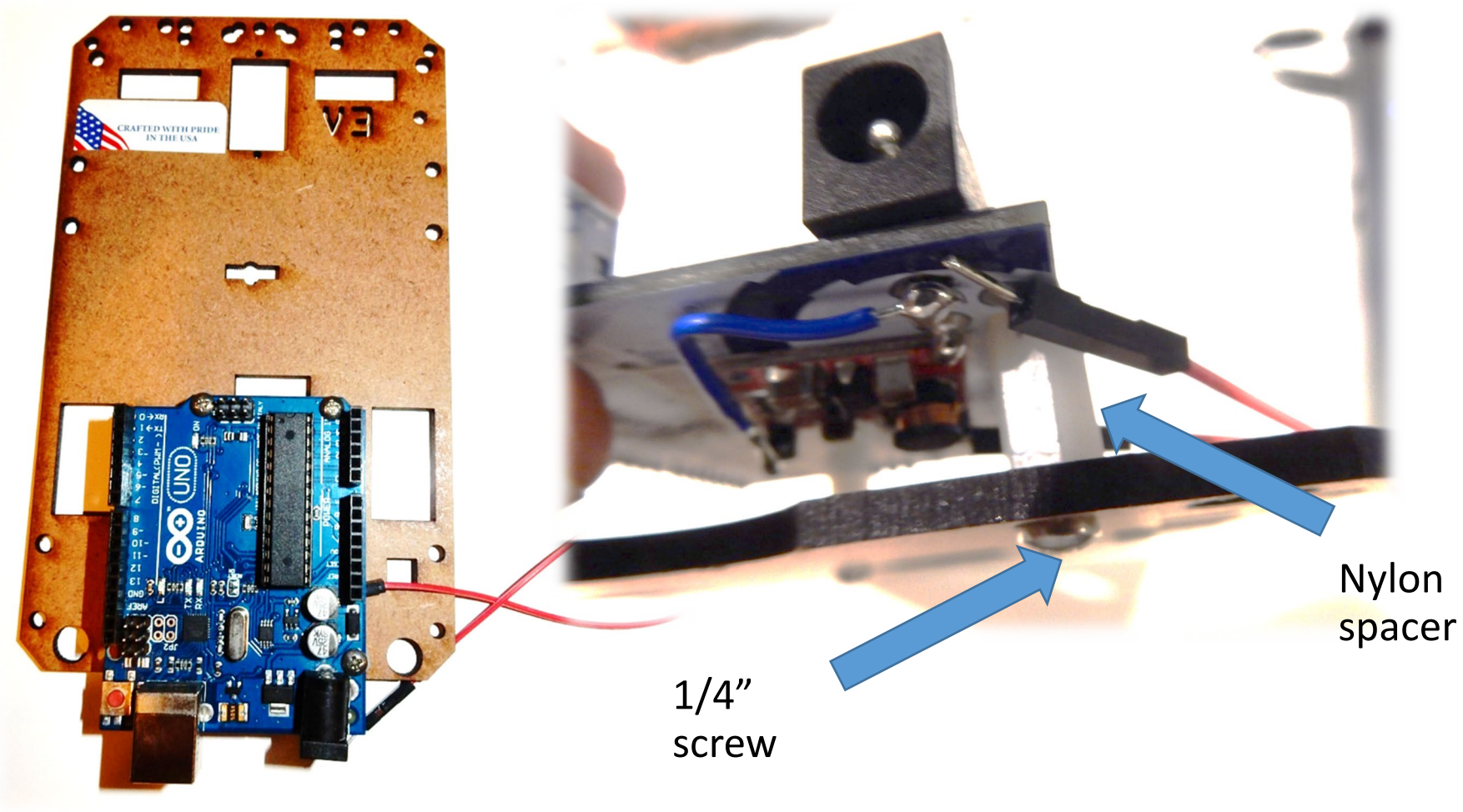


Use the three nylon spacers and three 1/4” screws and install the spacers on the Arduino board as shown below. **Do not tighten yet!**

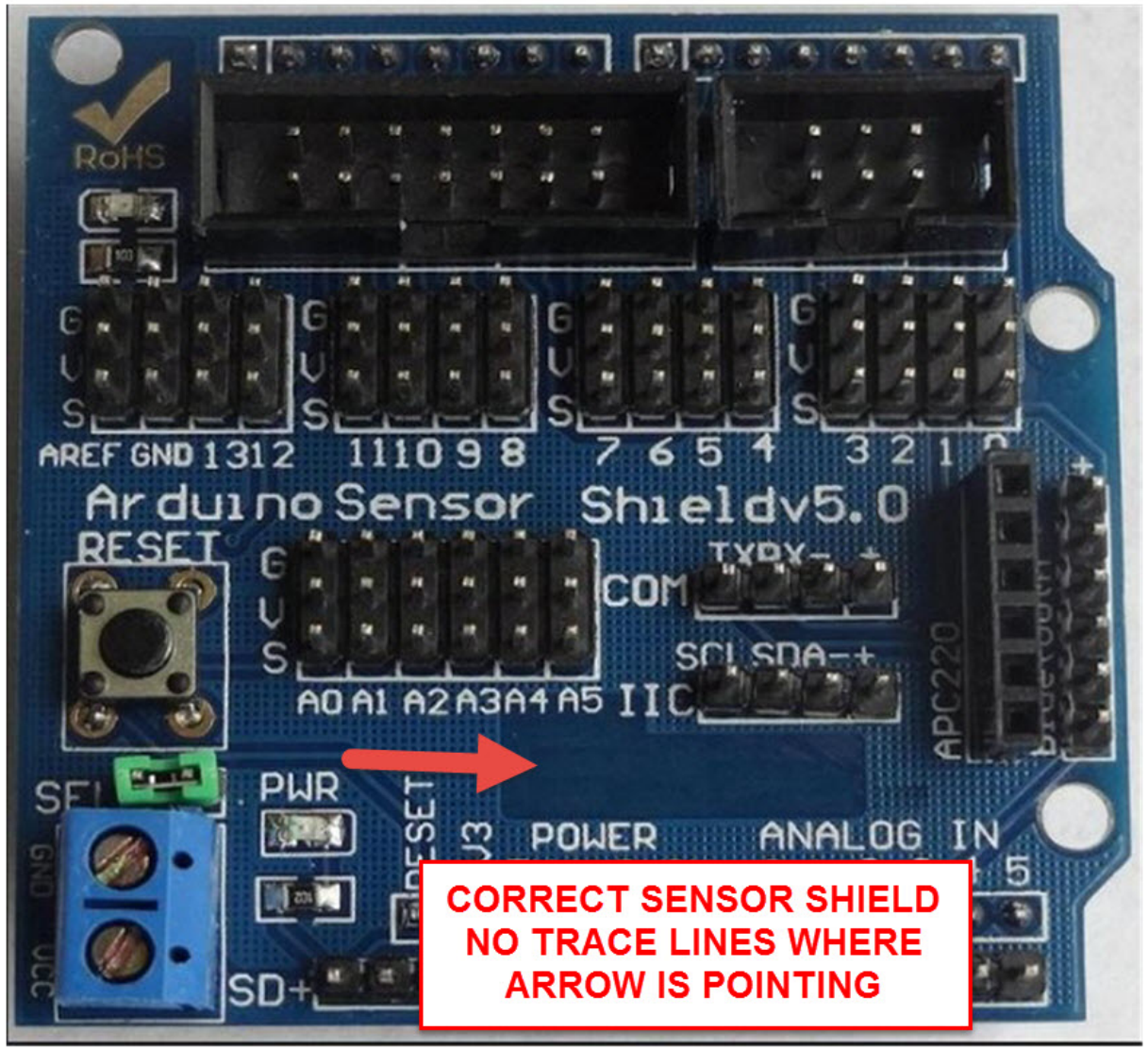


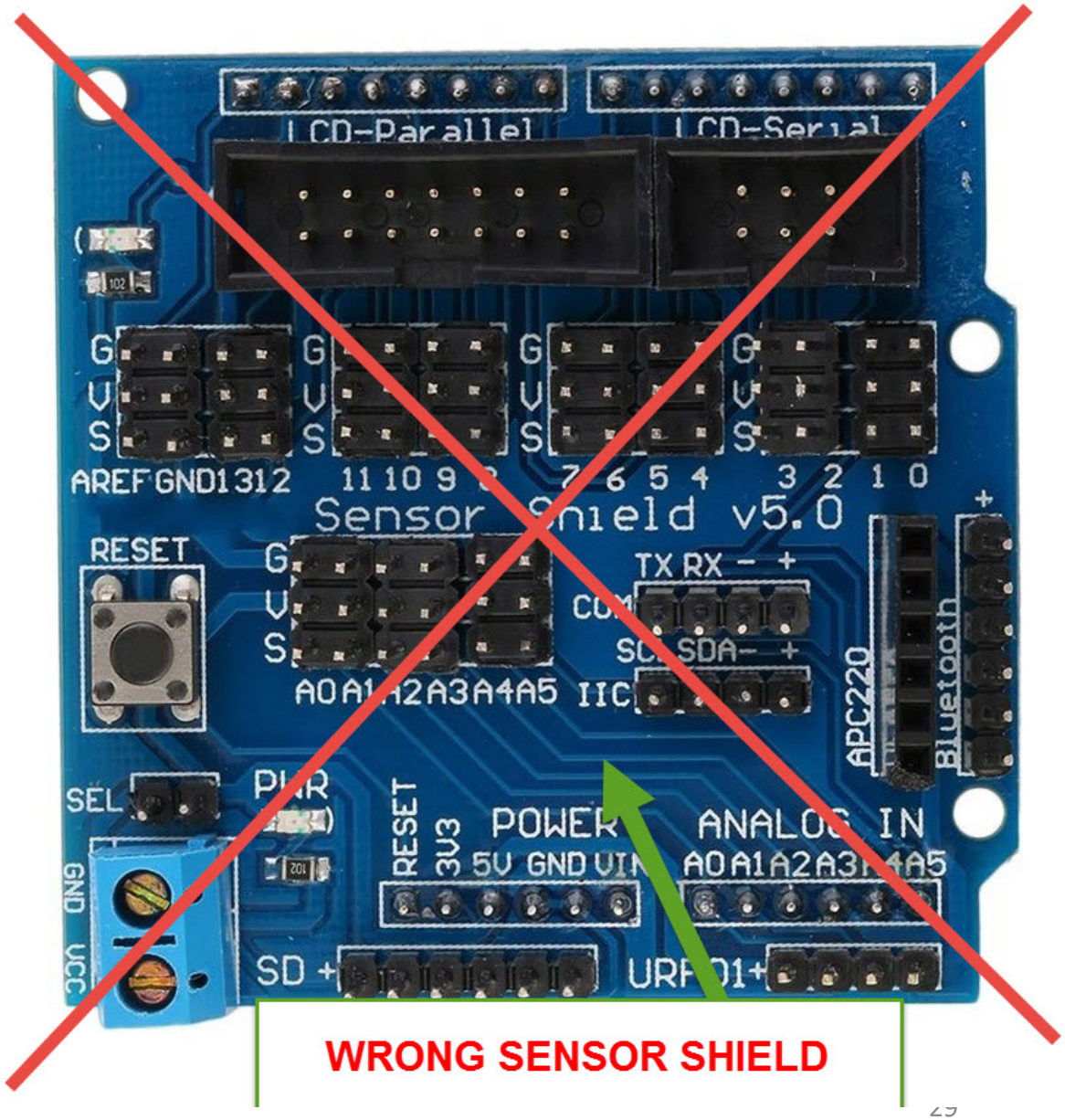
Assembling Arduino board on upper chassis

Note:
Arduino board can only go in one direction. The holes on the upper chassis match the direction the Arduino board should go



Make sure you have the correct Sensor Shield

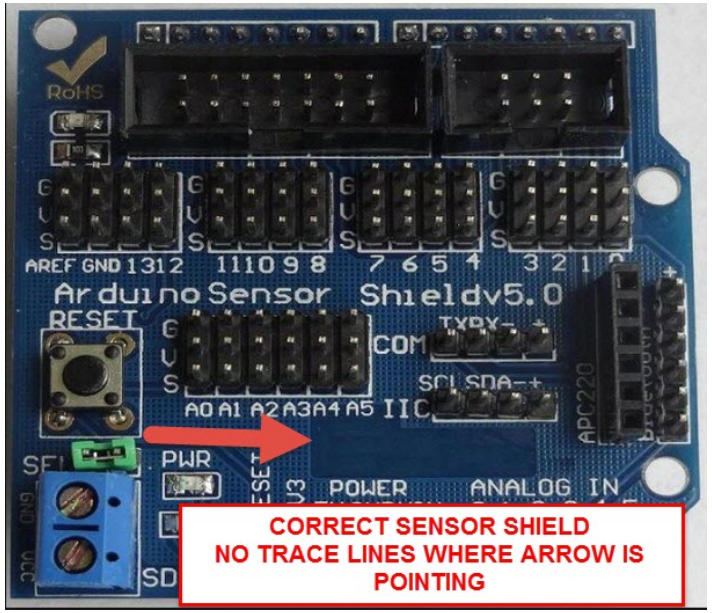




Mounting the Arduino Sensor Shield v5.0 on the Arduino board

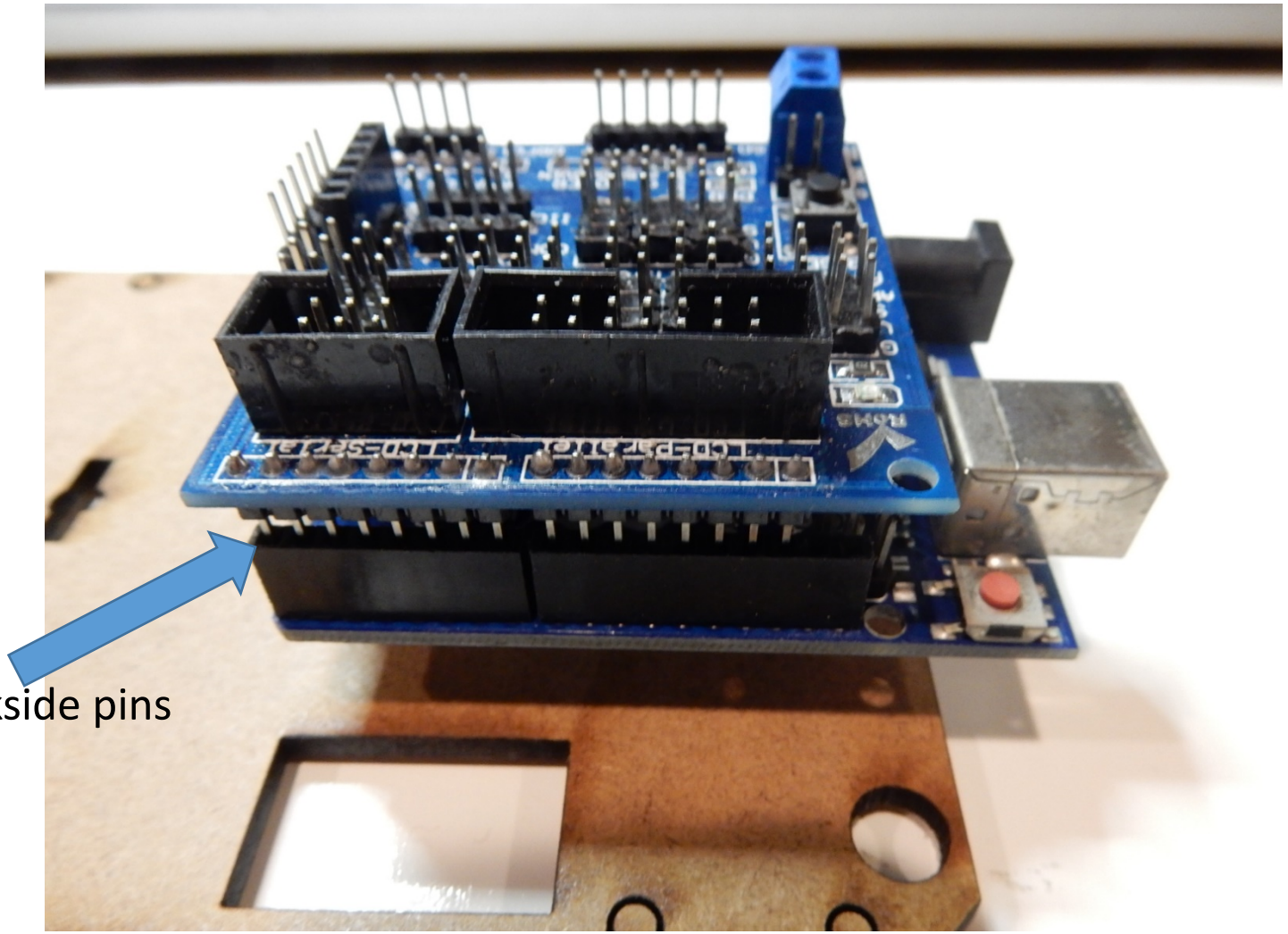
Parts

- Upper chassis
- Sensor Shield 5.0



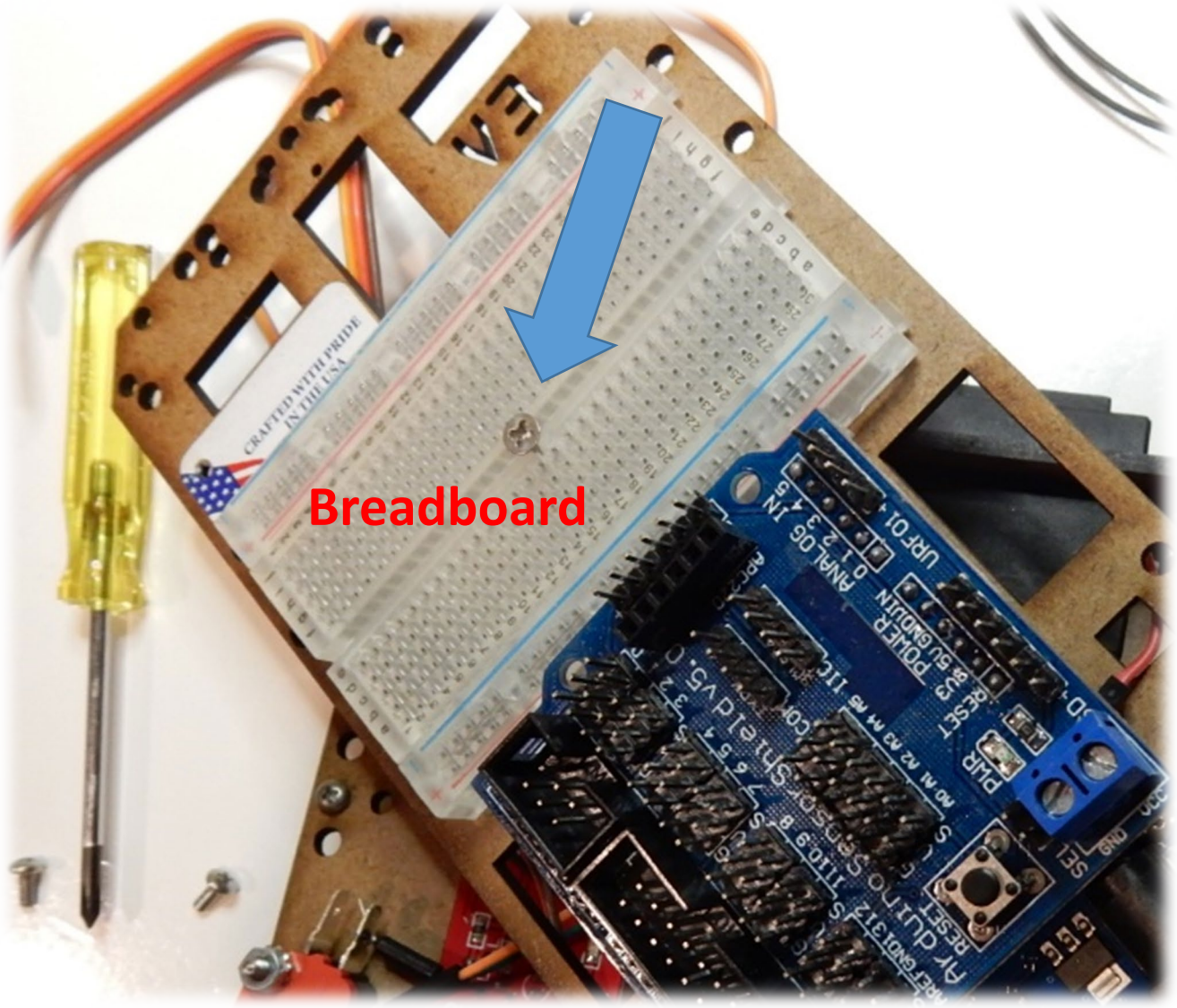
Sensor Shield 5.0

Notice position of pins and direction. Start from the back pins to the front pins. The press all the way down.



Backside pins

Step 8 : Mounting the breadboard or protoboard



Parts

- (1) upper chassis
- (1) breadboard
- (1) 1” flathead screw
- (1) locking nut
- Star screwdriver

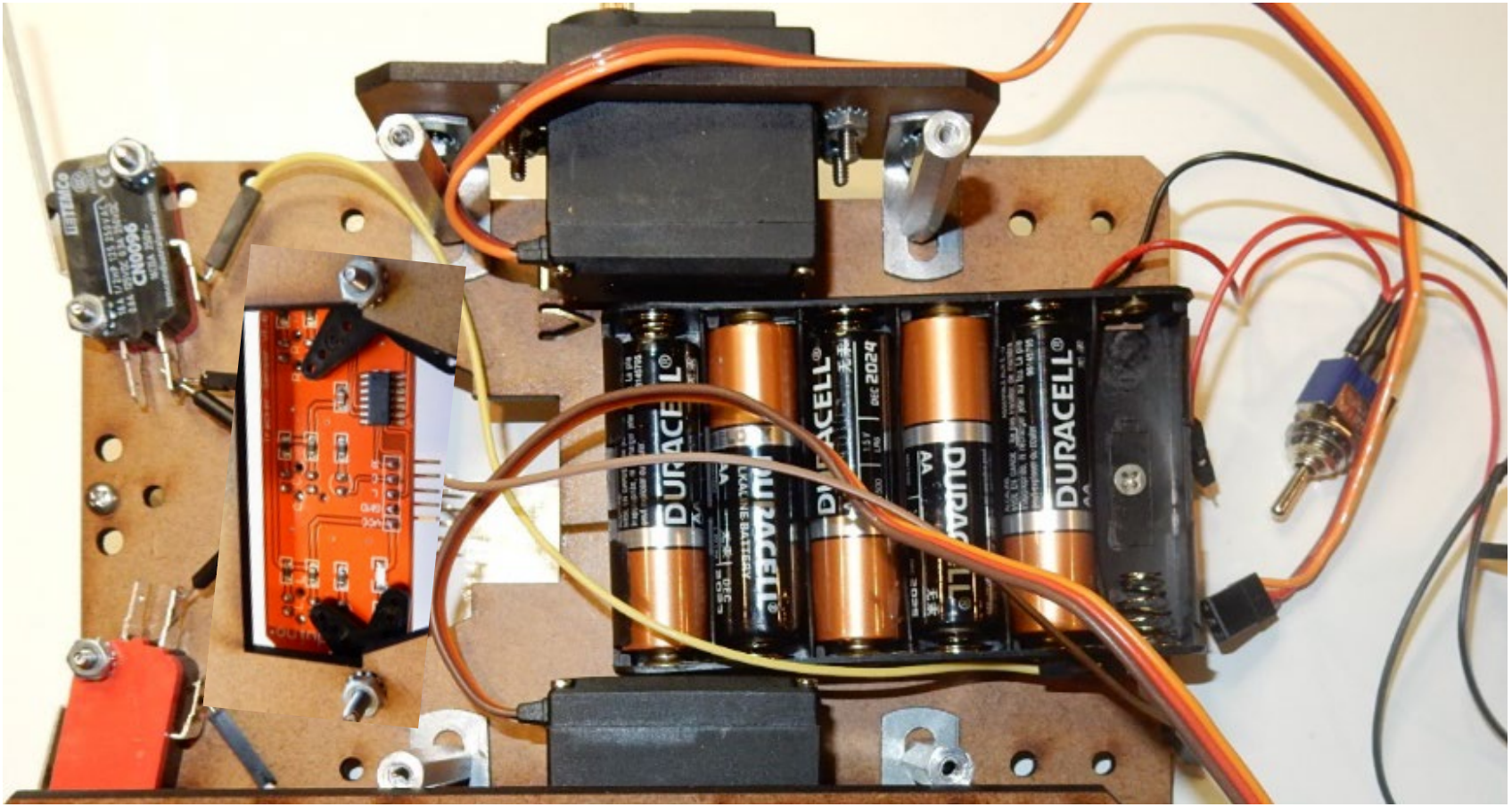
Install the breadboard as shown using the 1” flathead screw (see breadboard packaging for this screw). Align the breadboard in the middle and use locking nut to tighten

Step 9: Install 5 AA Batteries as shown below

Parts

- Lower chassis
- (5) AA batteries

Note!: we will install the sixth battery once everything is connected



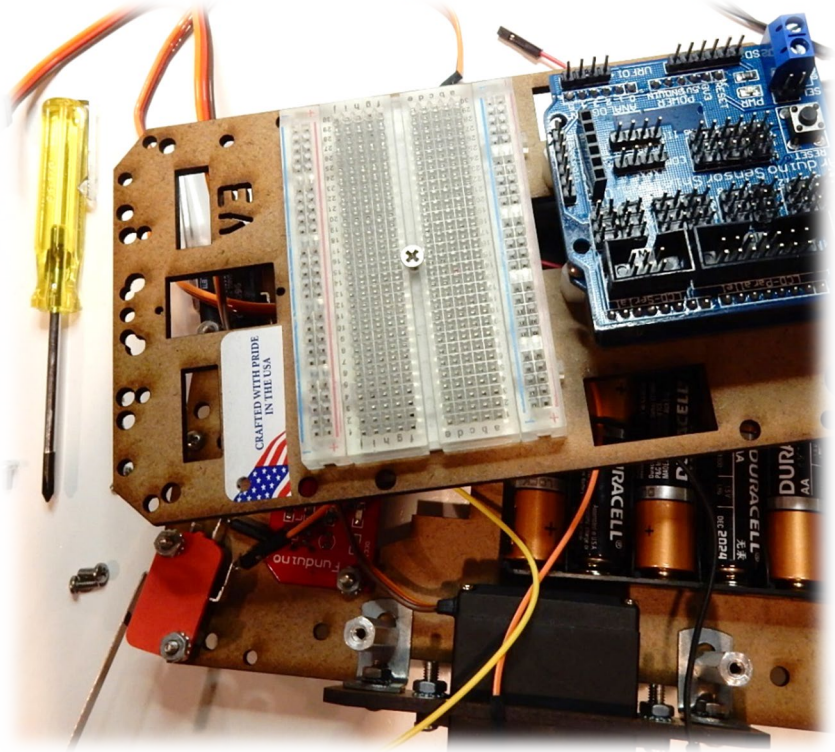
Step 10: Install Upper Chassis on Metal Spacers

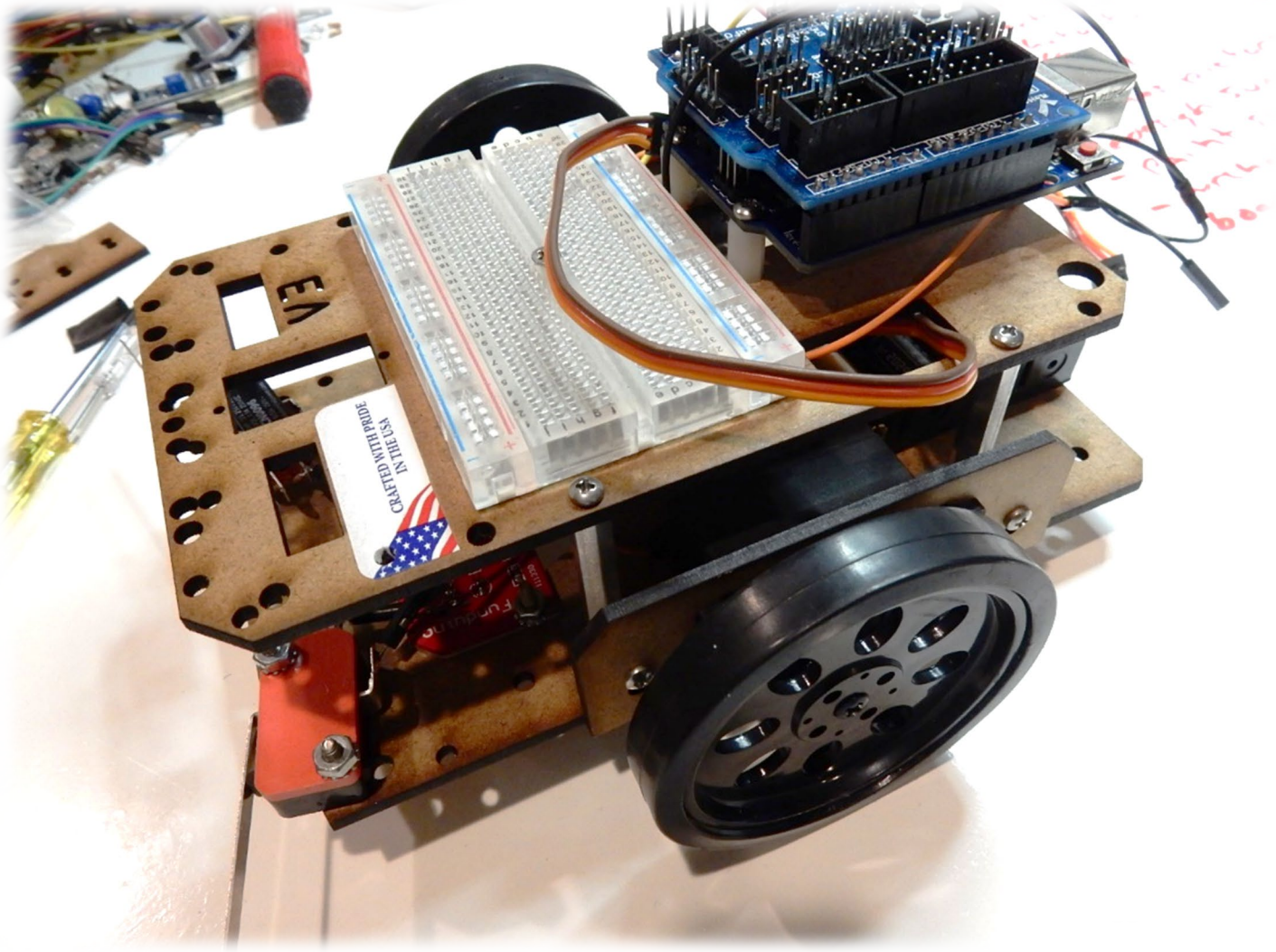
Mount the upper chassis to the four metal spacers as show below using the ¼ inch screws. Also install the **Arduino Sensor Shield** as seen below.

Note:- Pull the servo and feeler wires thru the holes as shown below for each side

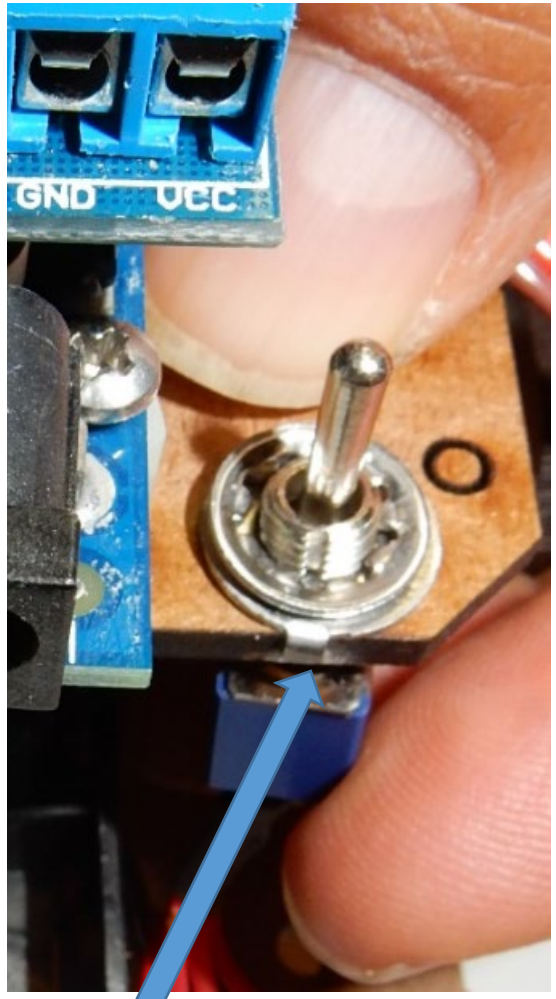
Parts

- Upper chassis
- (4) 1/4” screws
- Arduino board
- Star screwdriver

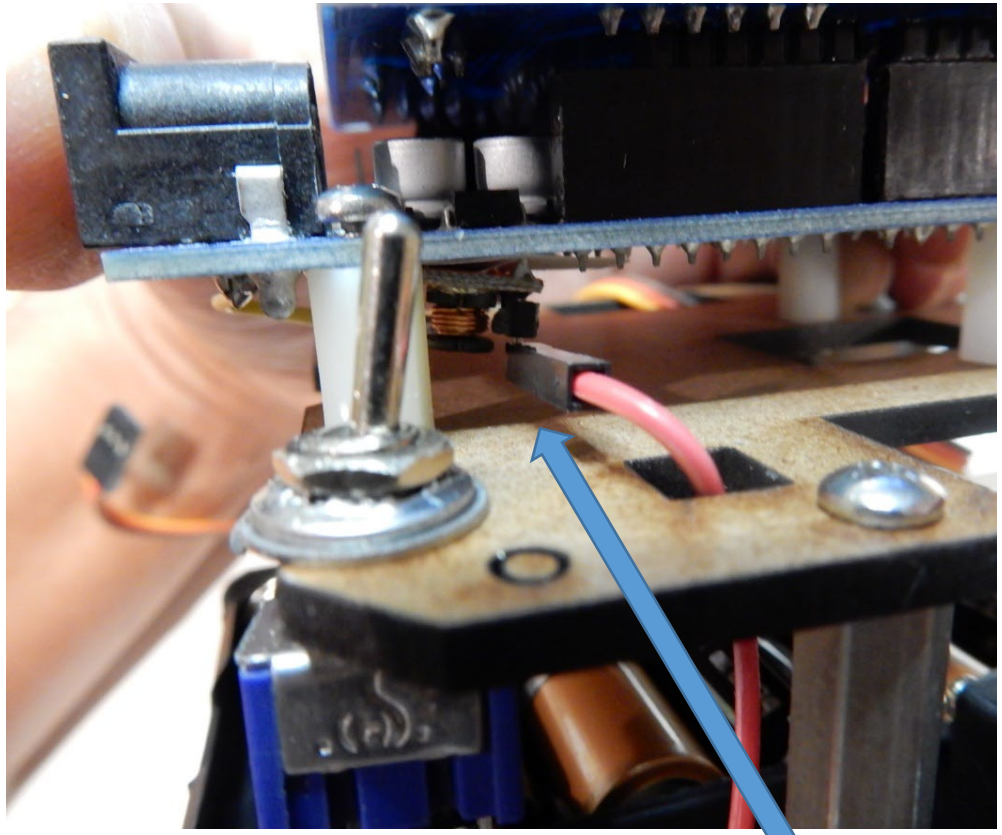




Step 11: Installing the Battery ON-OFF switch and Power Connections



Run the red female DuPont wire from the battery holder to the bottom of the Arduino DC-DC converter pin thru the small square on the top chassis as shown on left and right pictures.

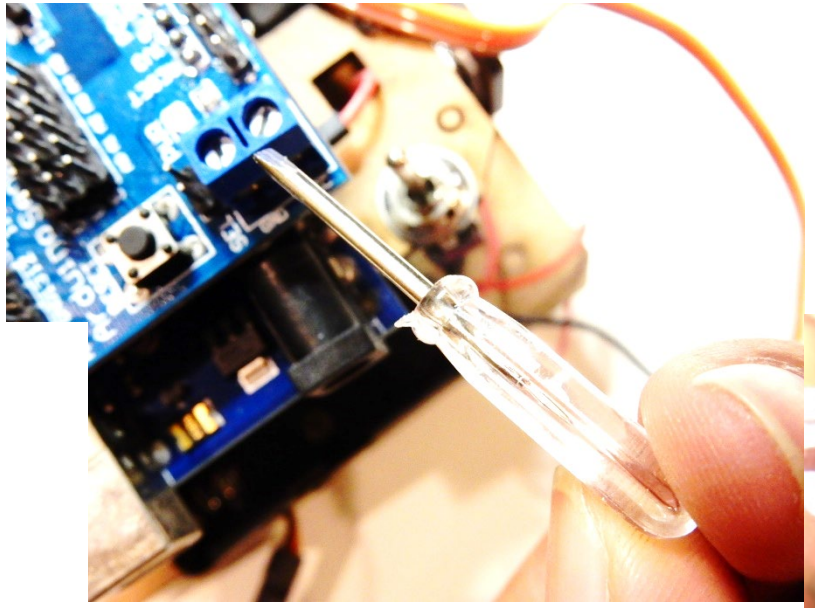


Bottom of Arduino board has a pin from the DC-DC converter and red extension DuPont cable. Connect it if is not already connected

Make sure metal tab from switch faces out of the laser cut chassis

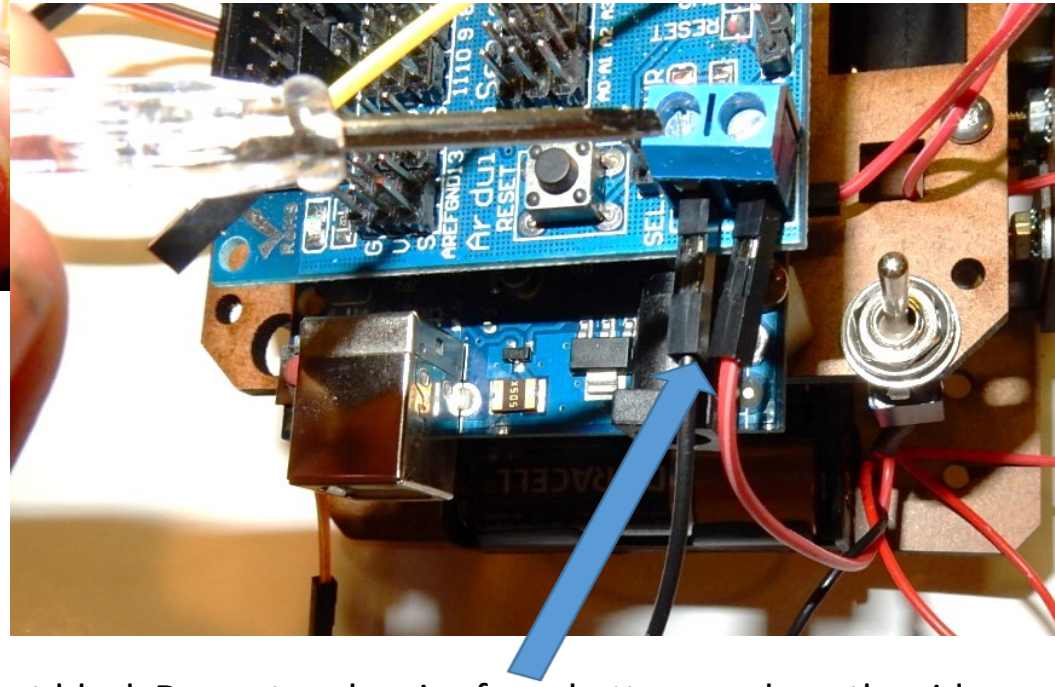
Connecting battery cables to the Arduino Sensor Shield

Parts
- Battery pack
- Sensor Shield V5.0
- Flat/or star screwdriver



Using the small flat screwdriver loosen the screw terminal connectors and insert wires then screw back in to secure. If robot turns ON just turn the switch to the OFF position

Sensor shield screw terminals



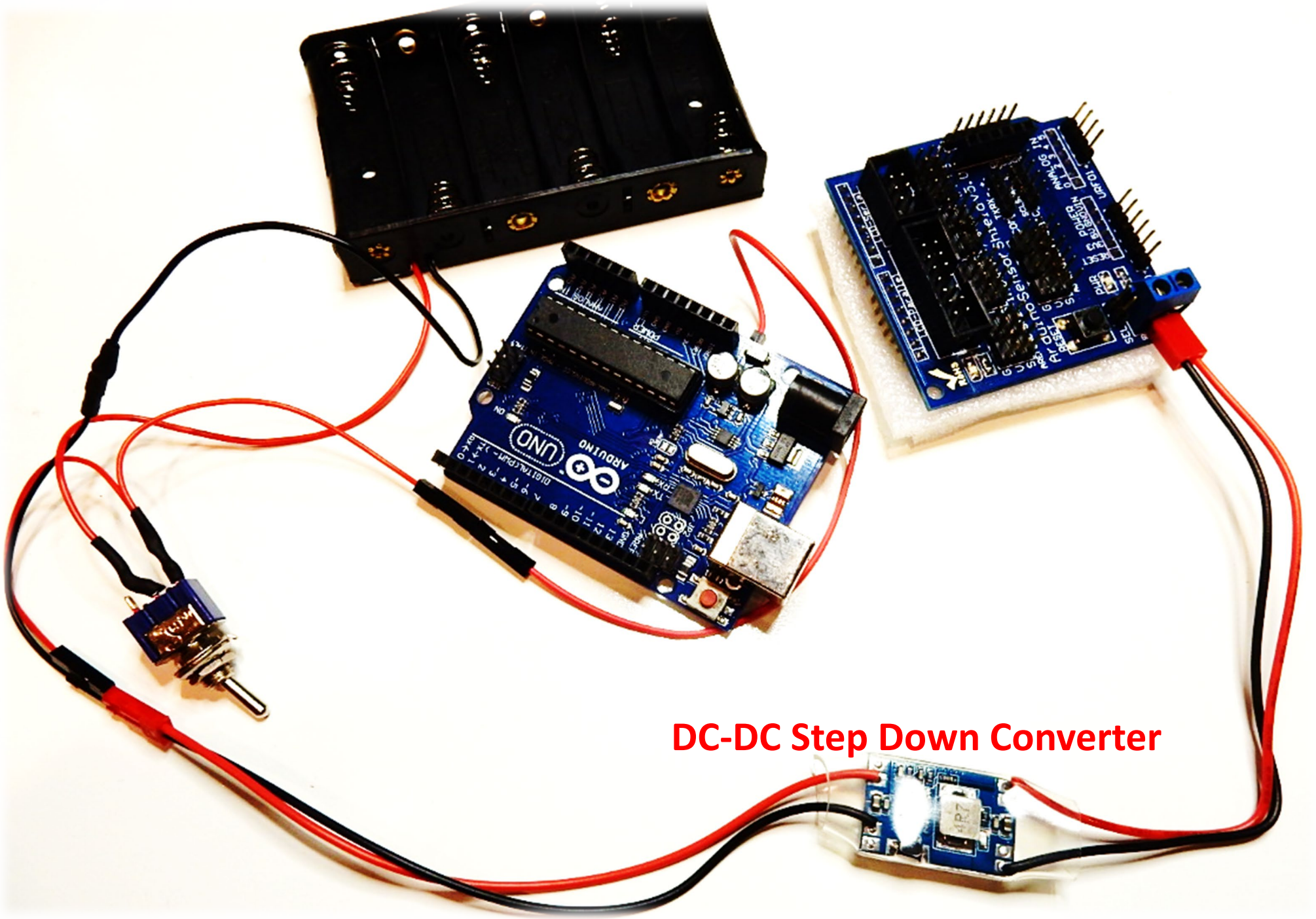
Connect black Dupont male wire from battery pack on the side labeled GND and the red Dupont male wire from the battery on the right side labeled VCC.

You can install the last battery now!

Reminder:Arduino, Battery Holder and Sensor Shield Connections

Make sure you connect your components as shown here

The Arduino board has a DC-DC step up converter to stablelize its voltage while under load or moving the robot. There is also a DC-DC step down converter to convert from 9V to 5V that powers the row of pins where motors will be connected to.

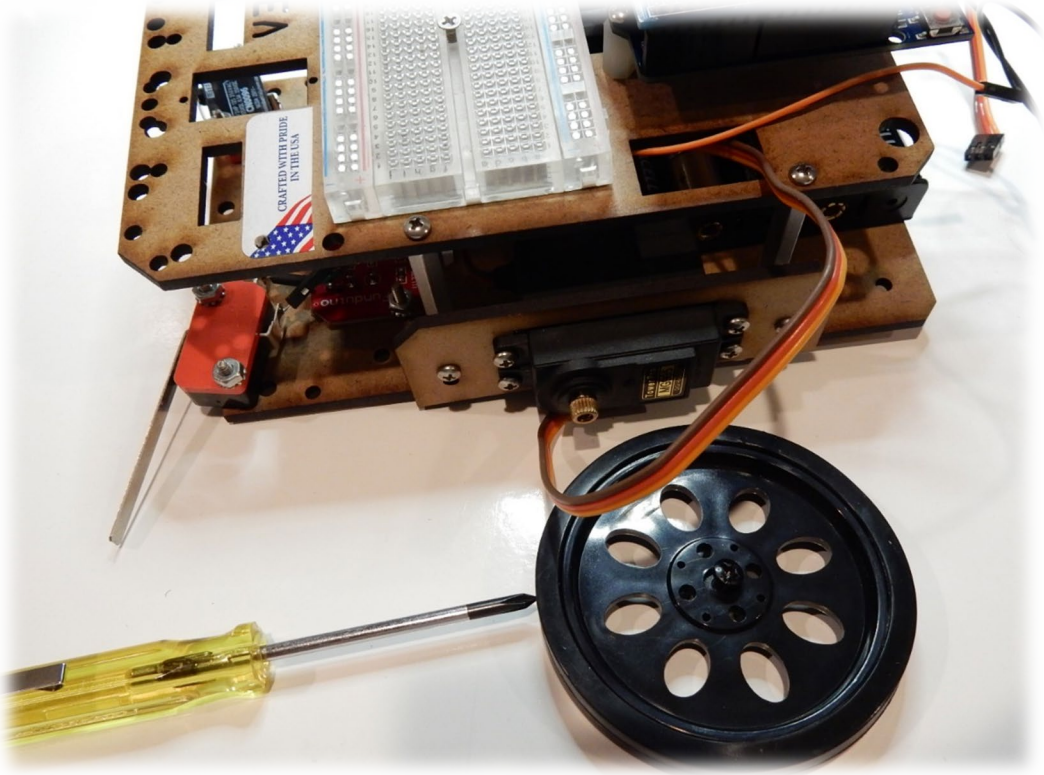


Step 12: Assembling the wheels

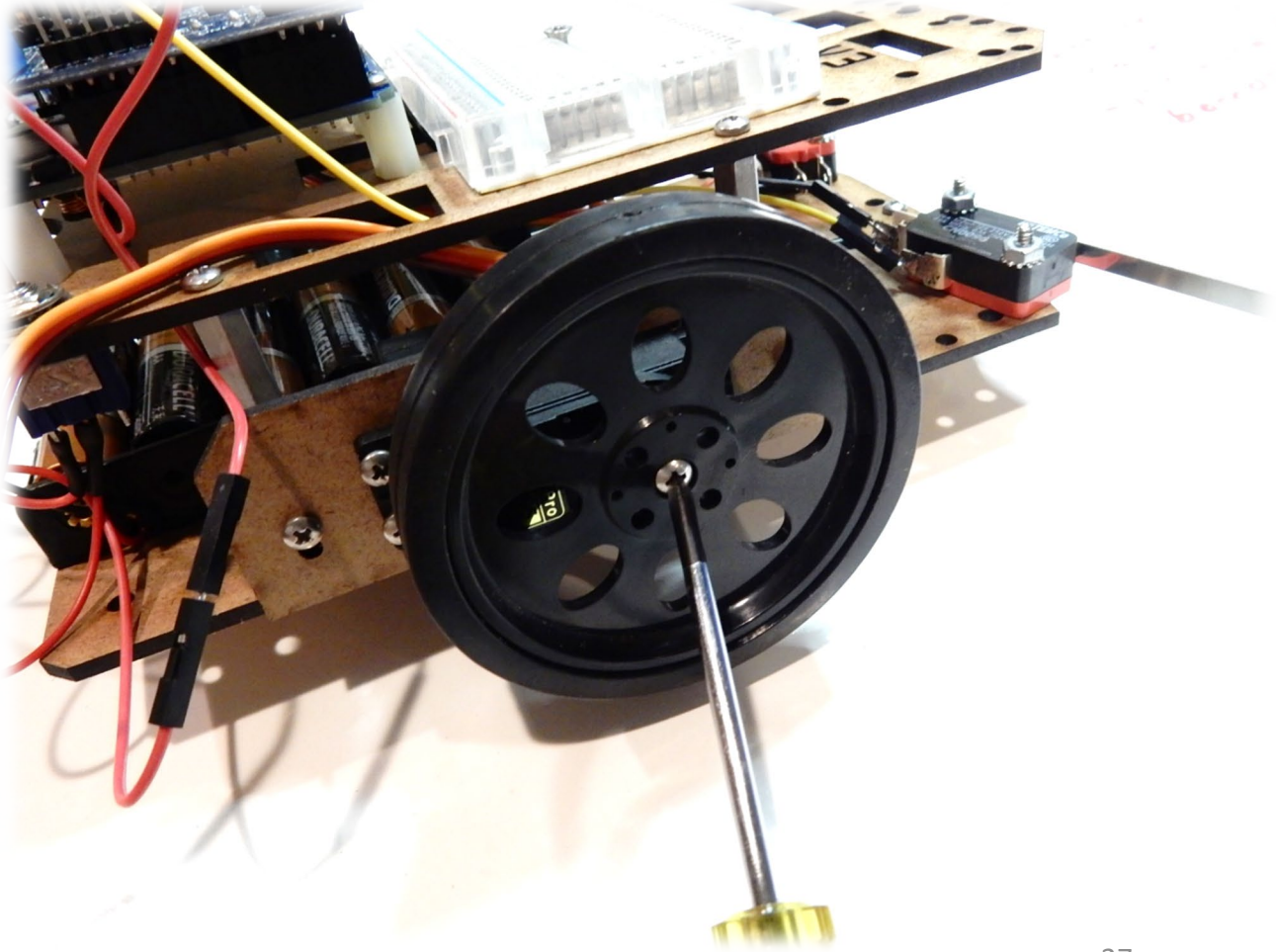
Insert wheel carefully, but with force to the shaft of the servo motor. Use only the screws that come in the bag of servo horns. These will make sure to hold the wheels.

Parts

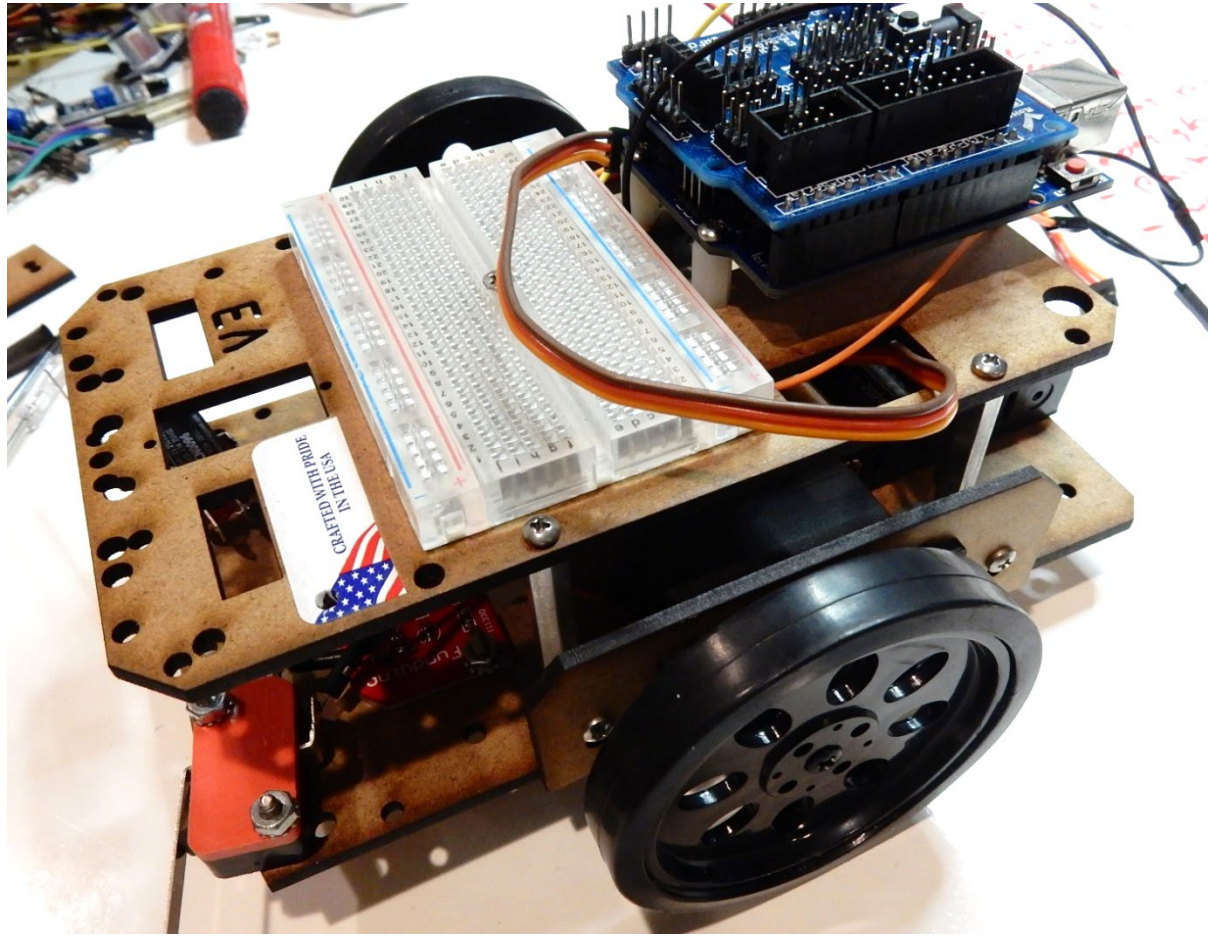
- (2) wheels
- (2) screws from servo motors parts bag to mount wheels
- Star screwdriver

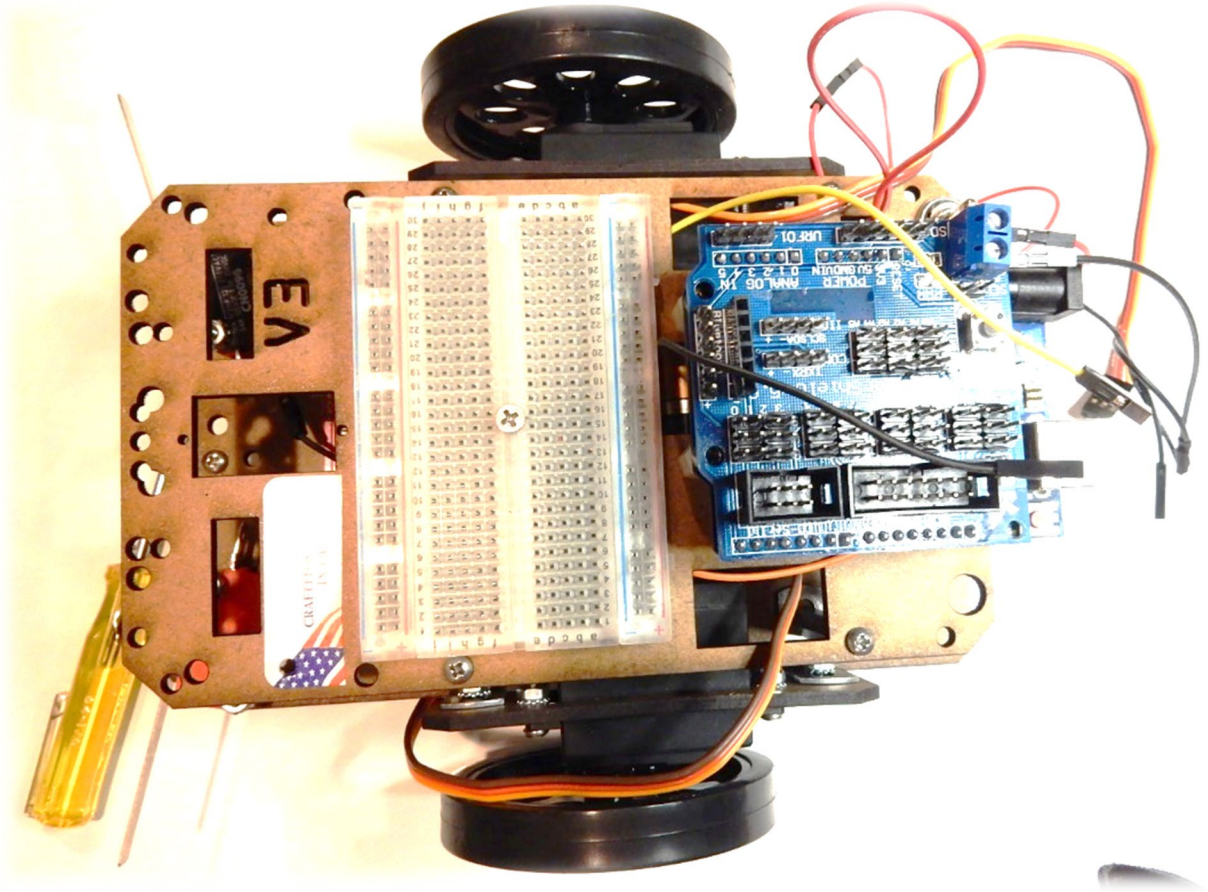


Wheel screws comes in the servo bags of spare horns



completed chassis and wheels assembly

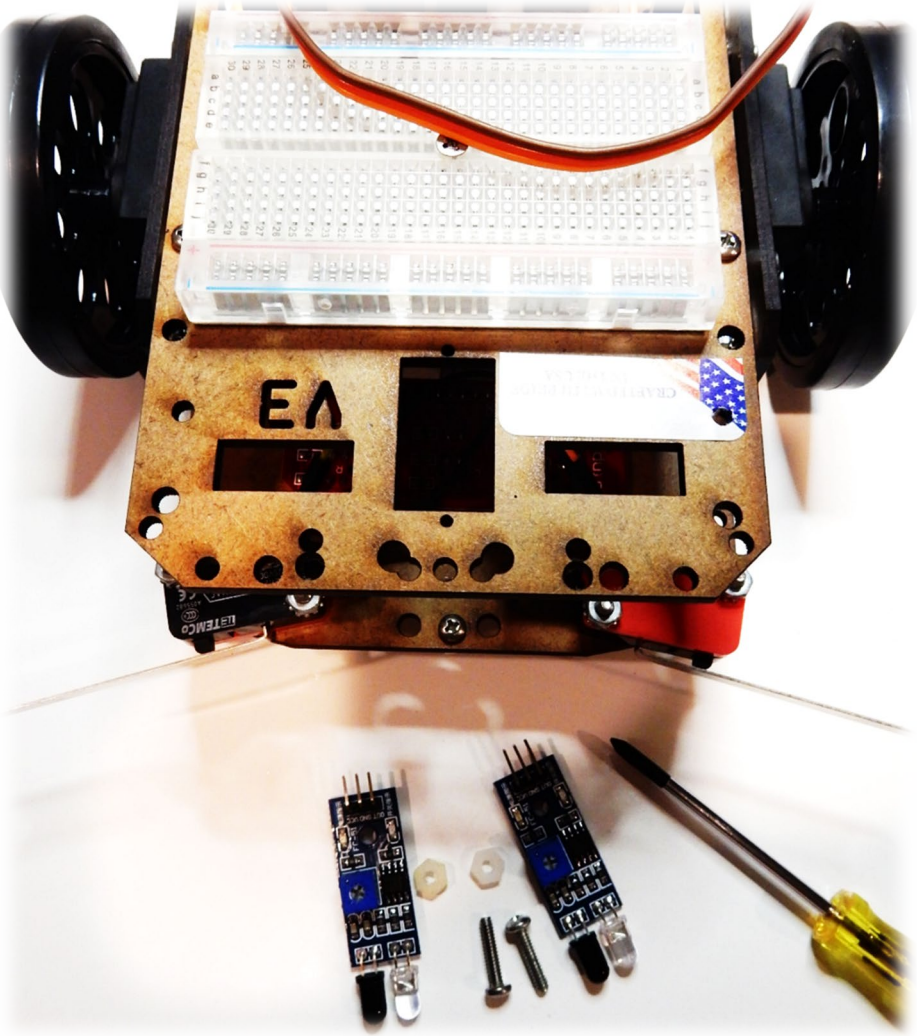


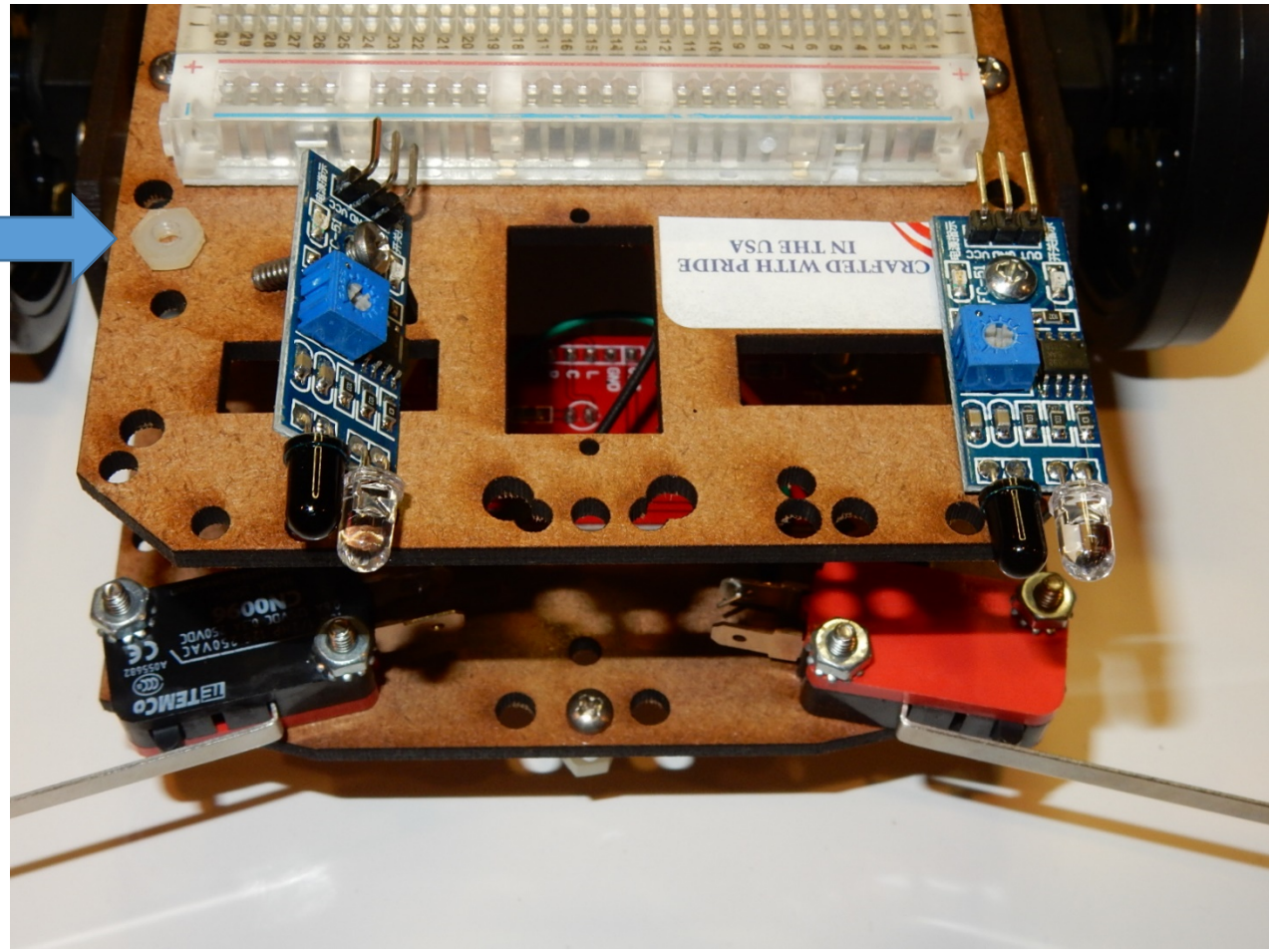


Step 13: Mounting the Adjustable Infrared Sensors

Parts

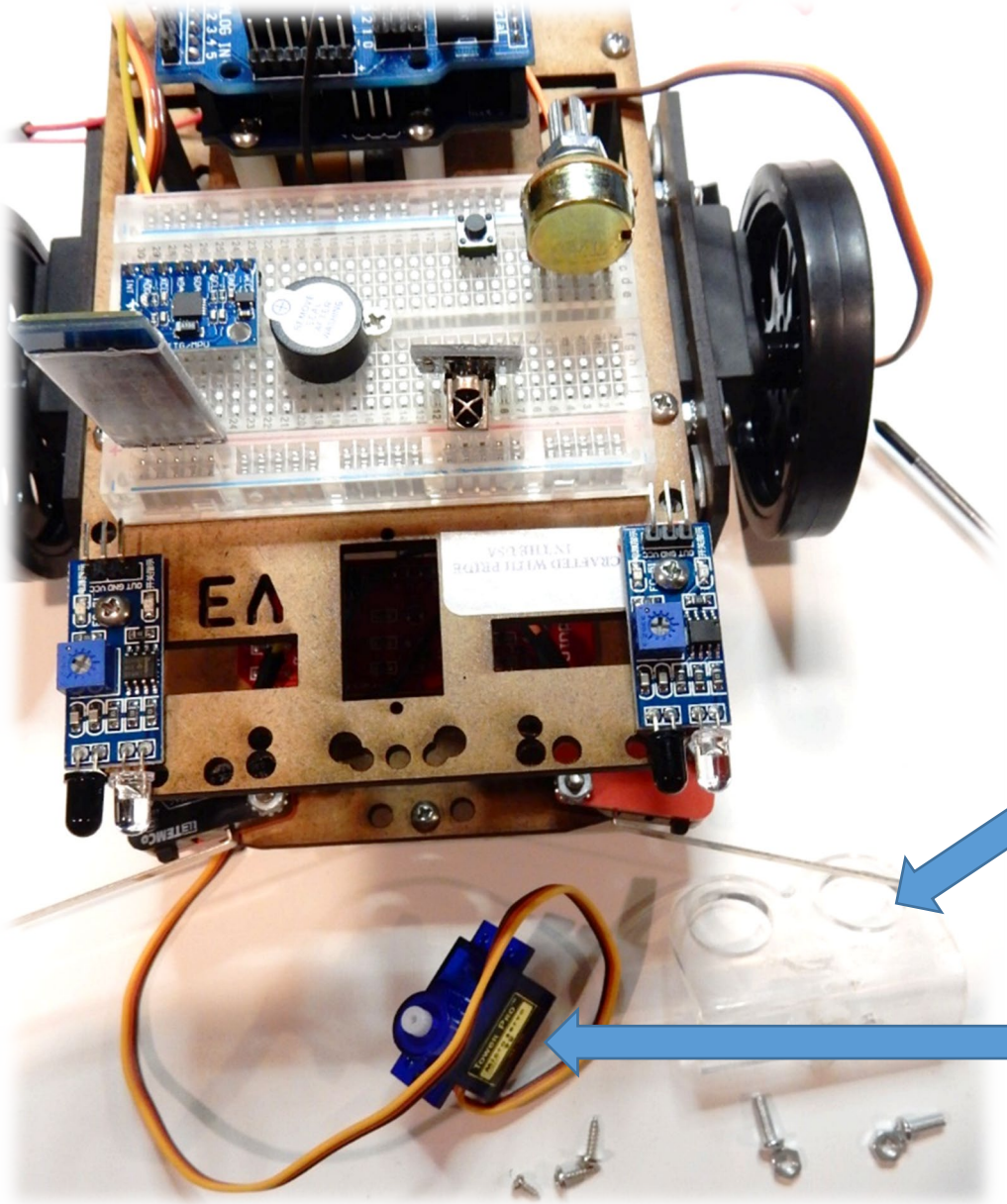
(2)Adjustable IR sensors
(2) 1/2” pan head screws
(2) Nylon nuts
Star screwdriver





Using the nylon nuts and 1/2 “ screws you can mount the infrared sensors in any location you want

Step 14: Mounting the Micro Servo and Sonar Sensor



Parts

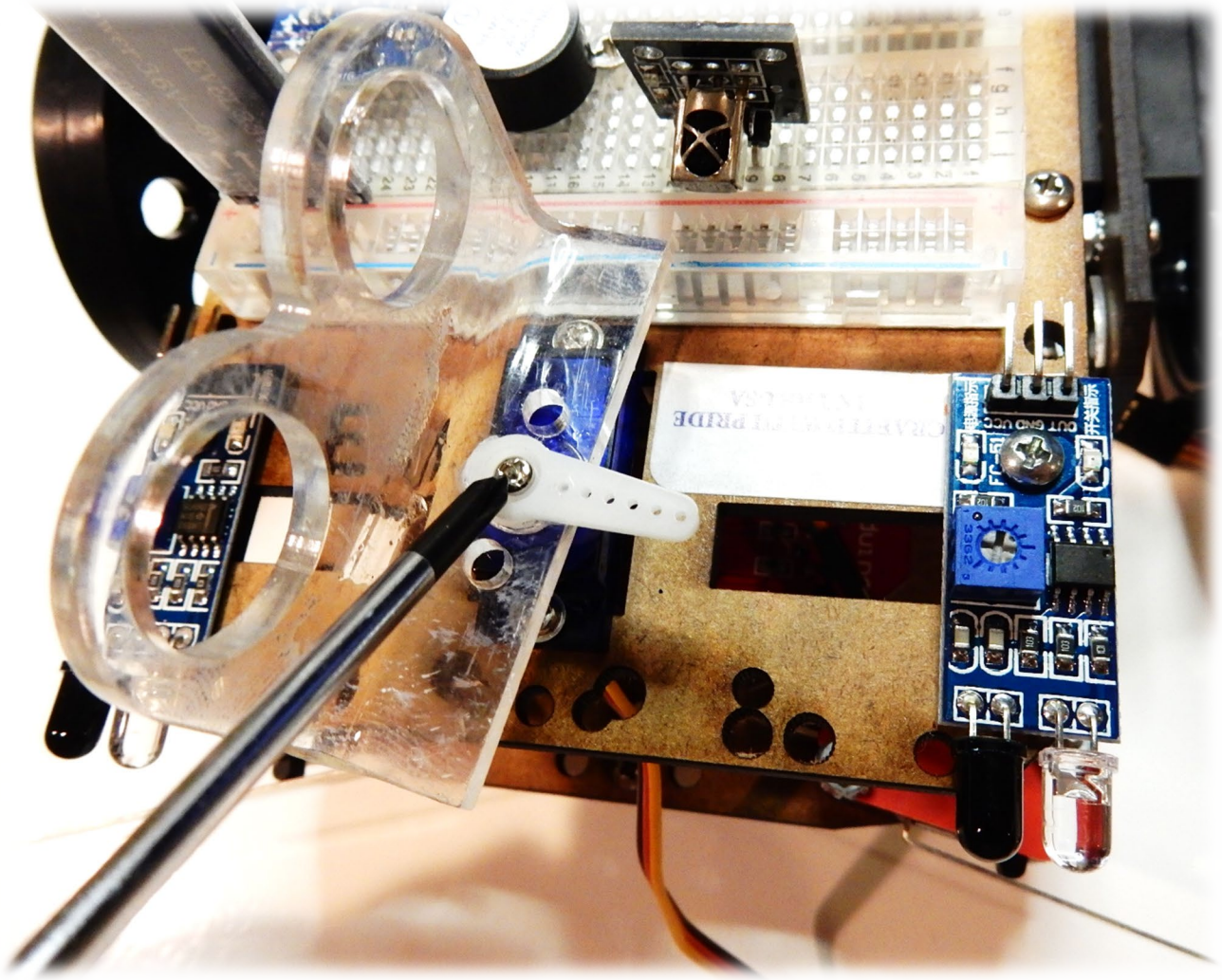
(1) Small blue micro servo motor
(1) Sonar sensor
(1) Sonar sensor clear bracket
Star screwdriver

Sonar sensor

Clear sonar sensor holder

Micro Servo and mounting screws

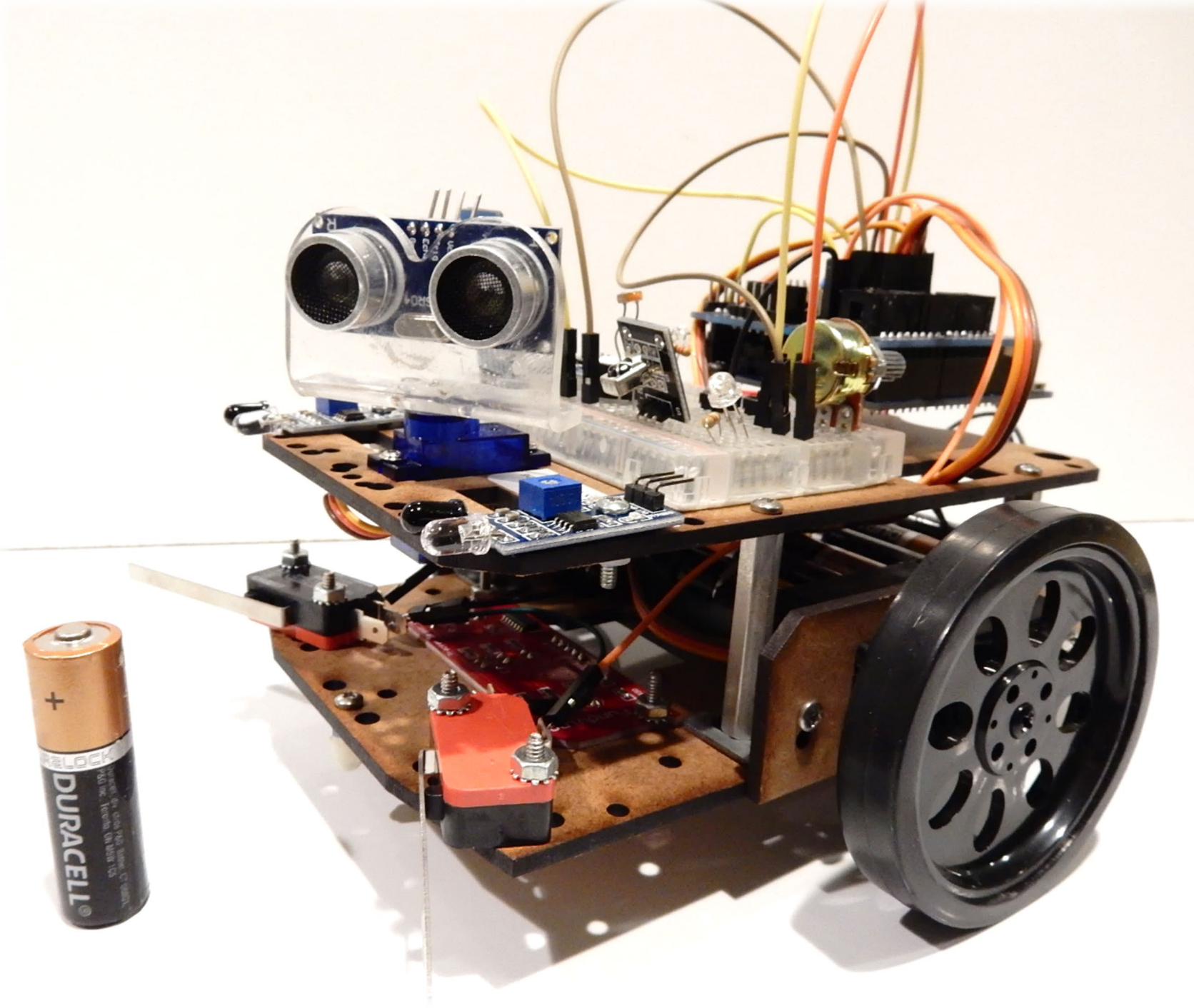
Mount micro servo on top chassis. Make sure motor shaft is facing the front of robot. Carefully screw the servo using the two small screws that came with it. The smallest screw of the three is to secure the sonar sensor clear bracket.



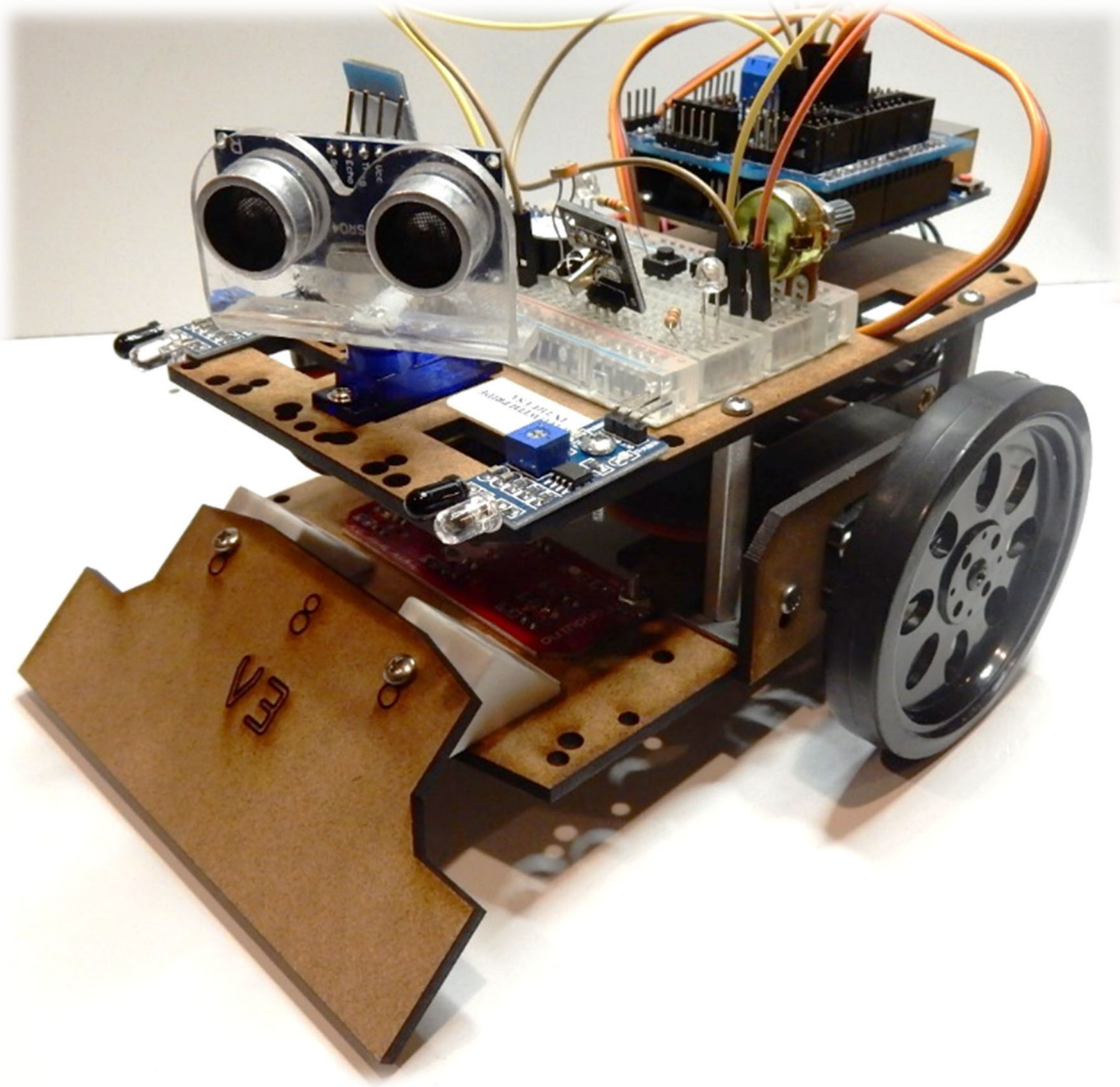
Completed robot with sample components on the breadboard!

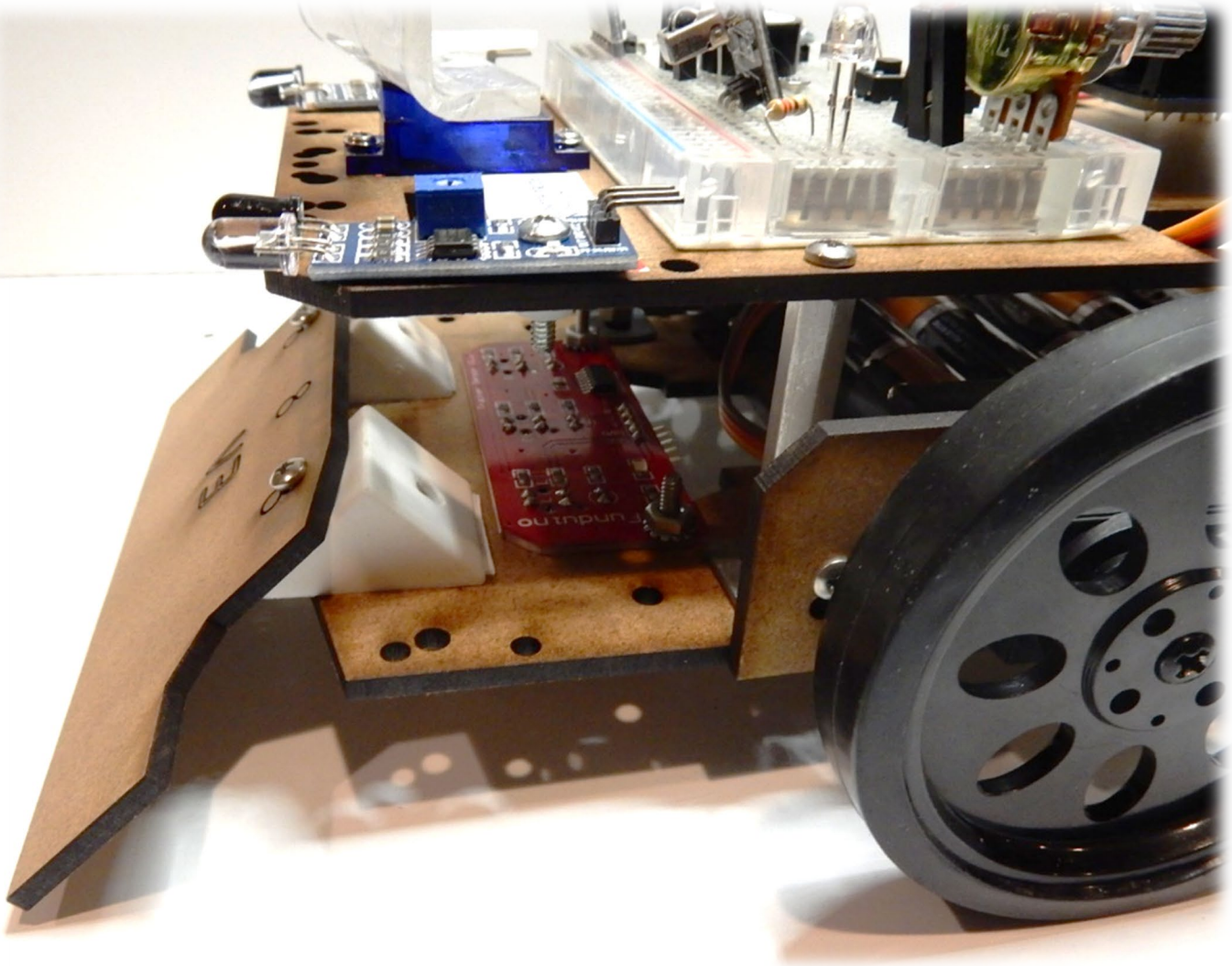
We are ready to try Experiment 1

Go to the website to download Experiment 1

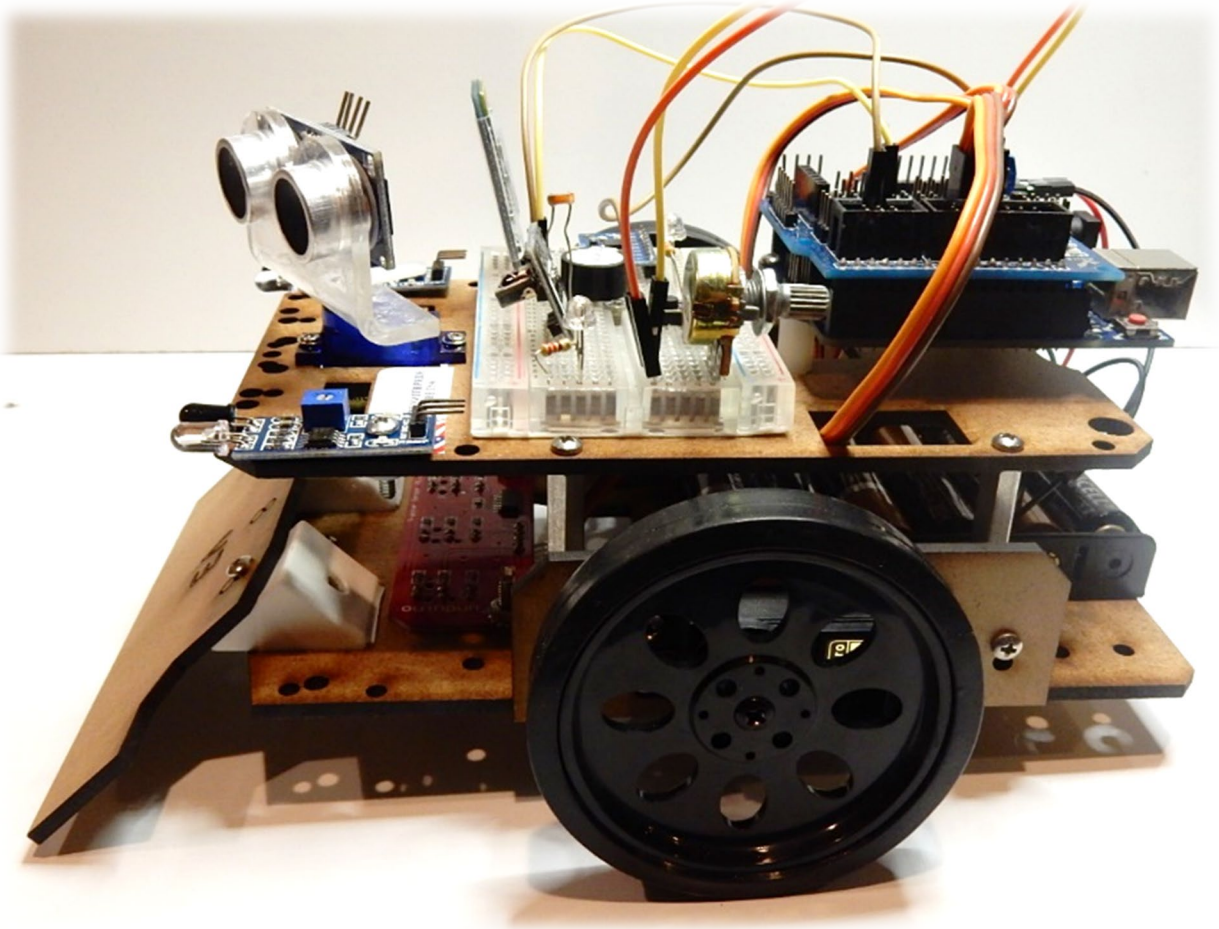


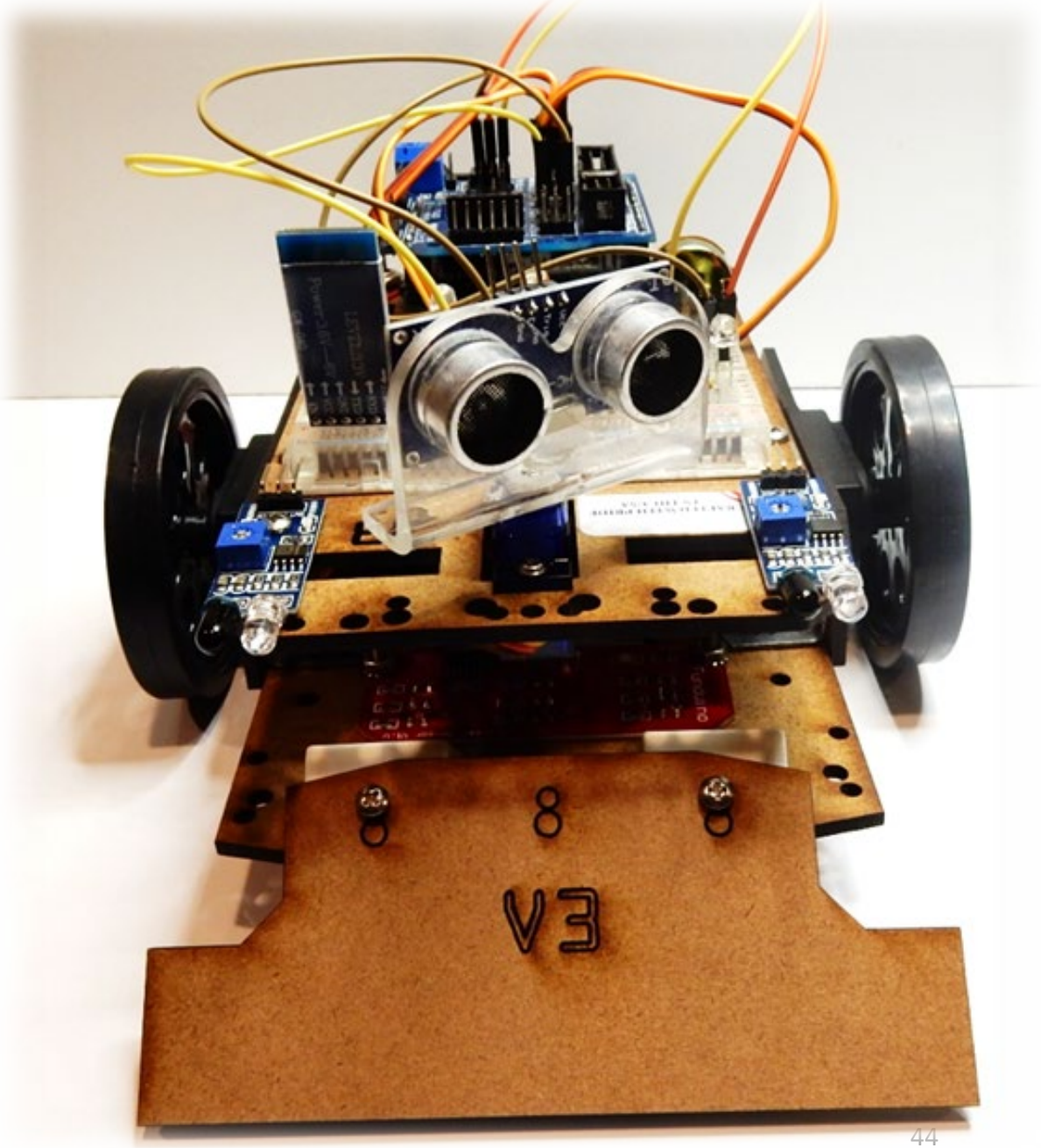
Sumo Robot – See Experiment 6 Sumo Robot for assembly instructions when ready



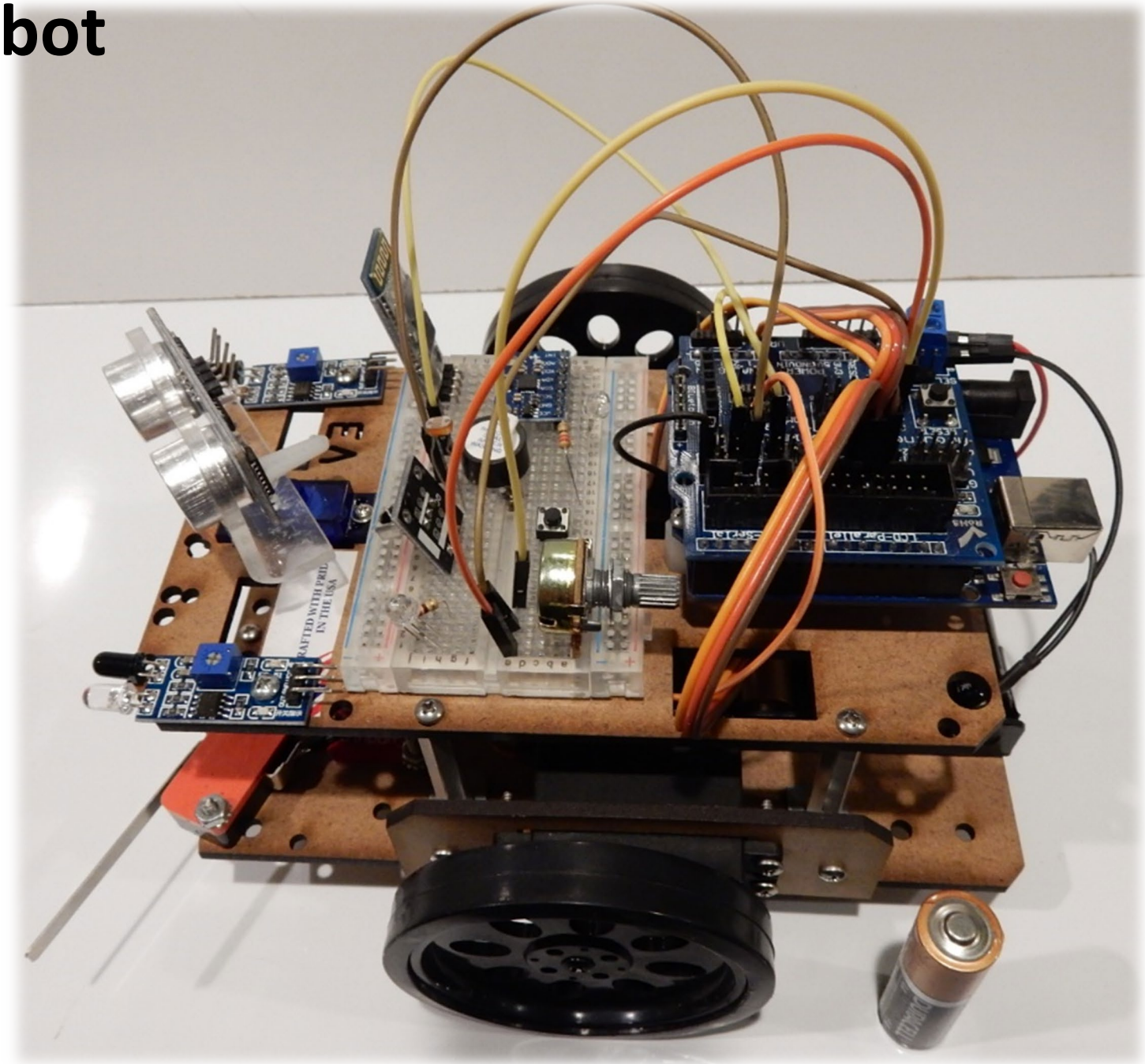


Sumo Robot

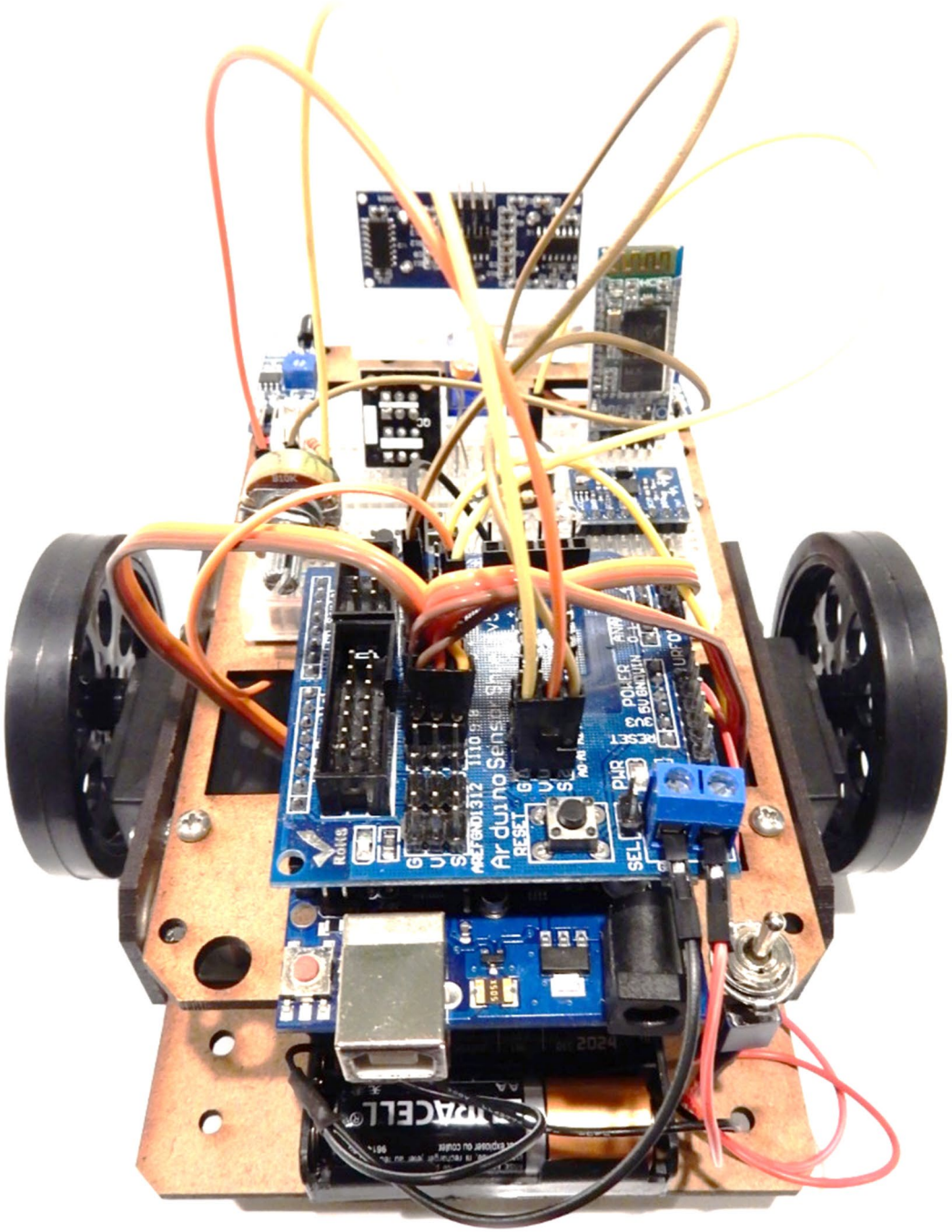




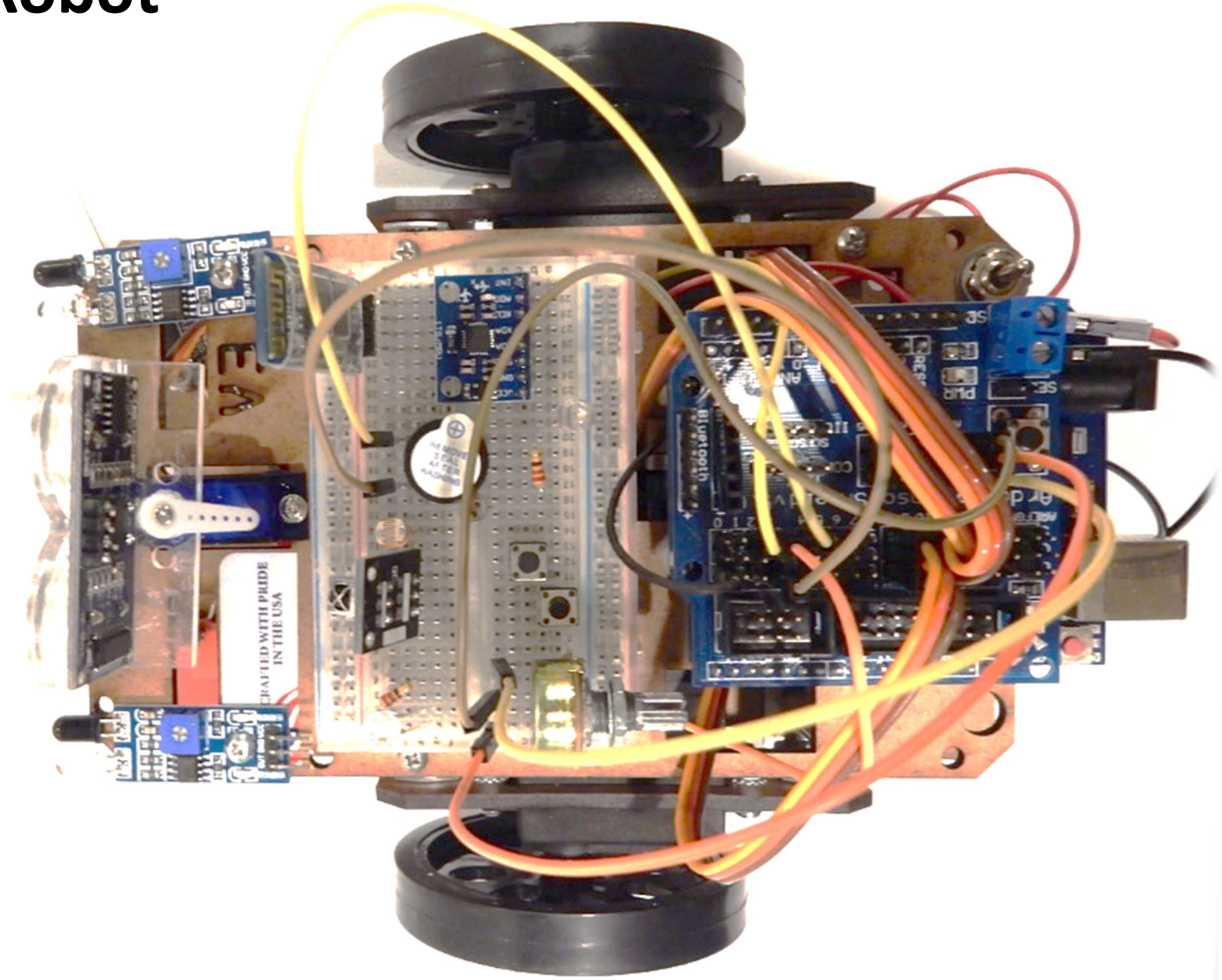
Completed Robot



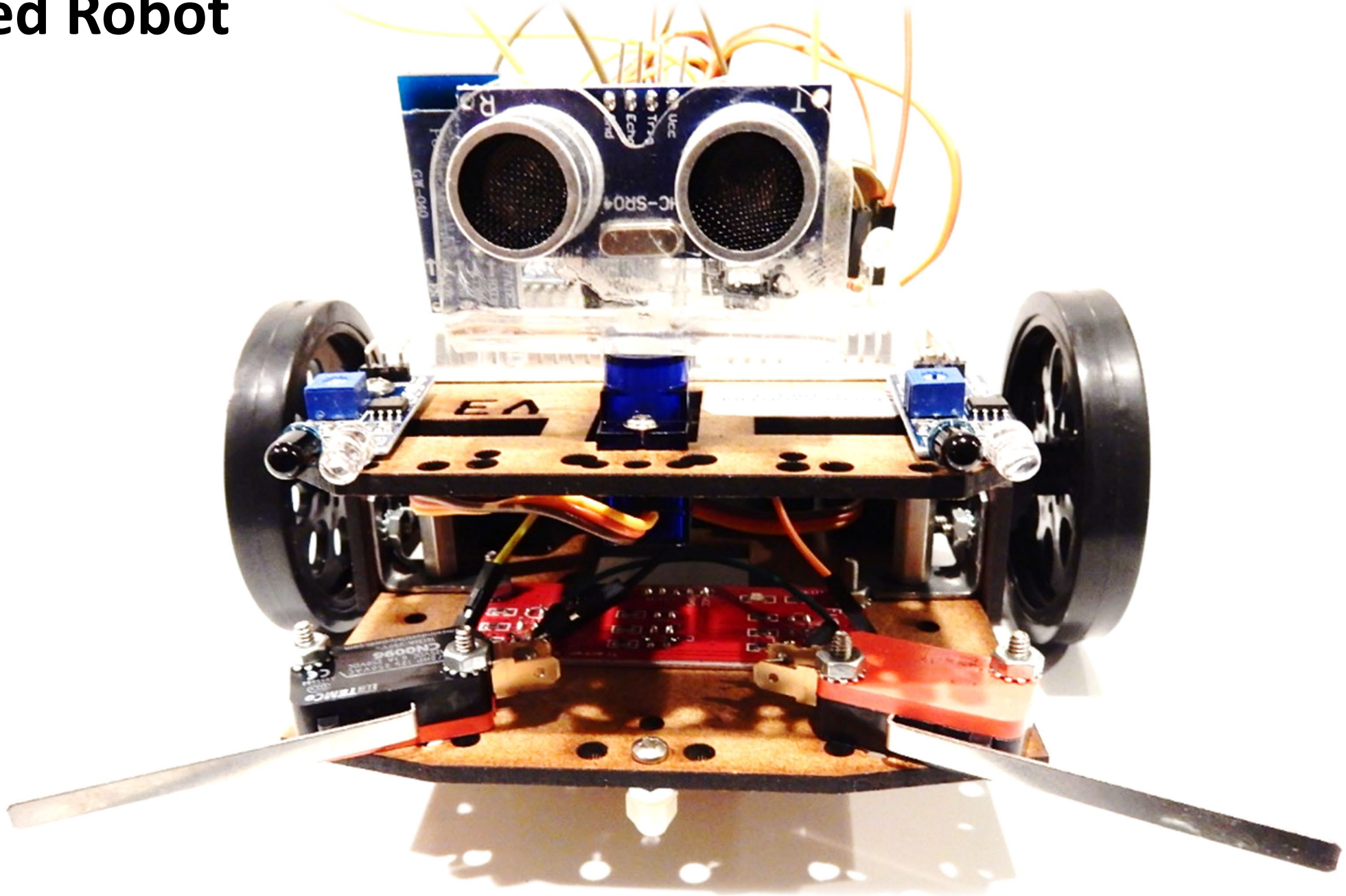
Completed Robot



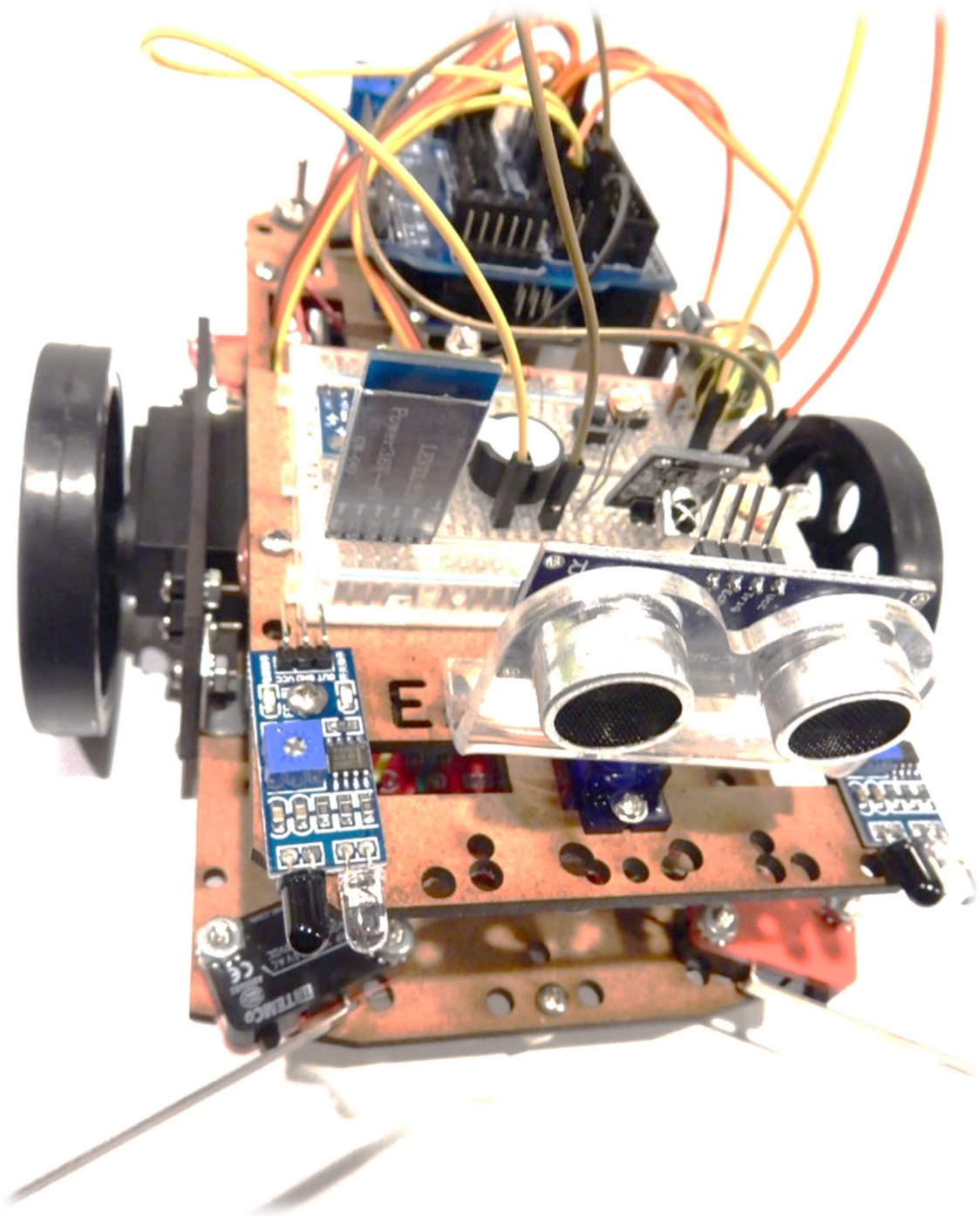
Completed Robot



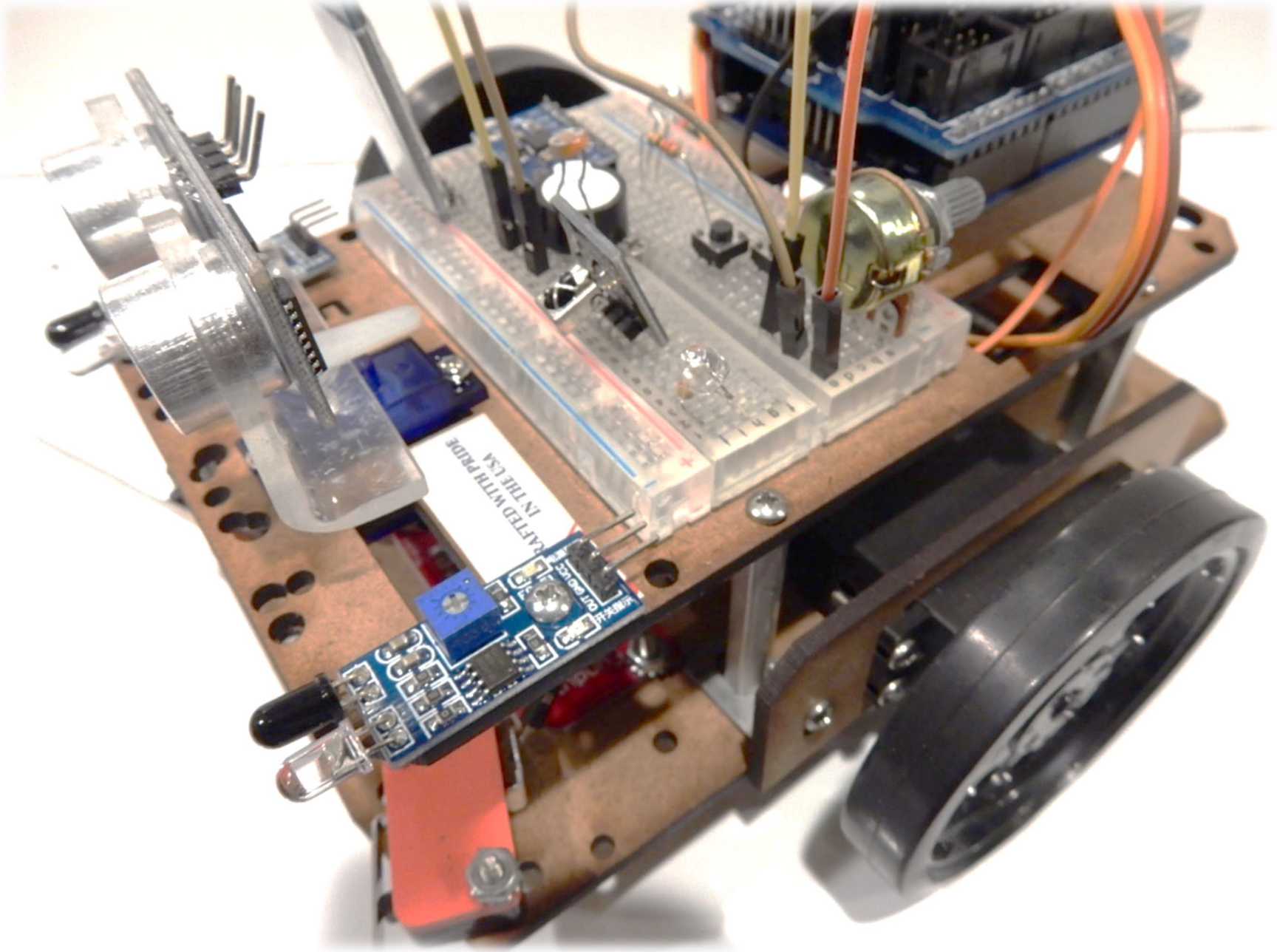
Completed Robot



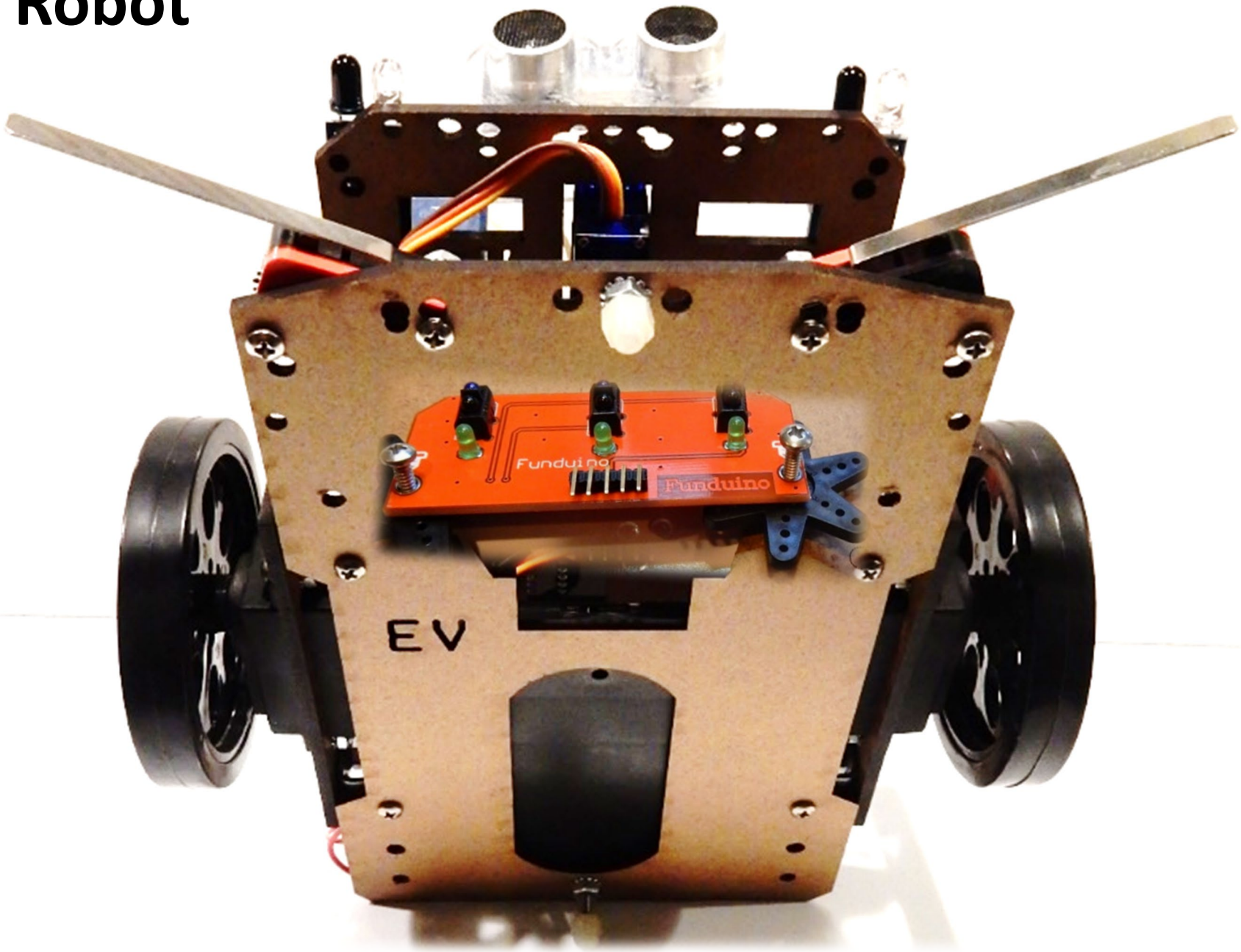
Completed Robot

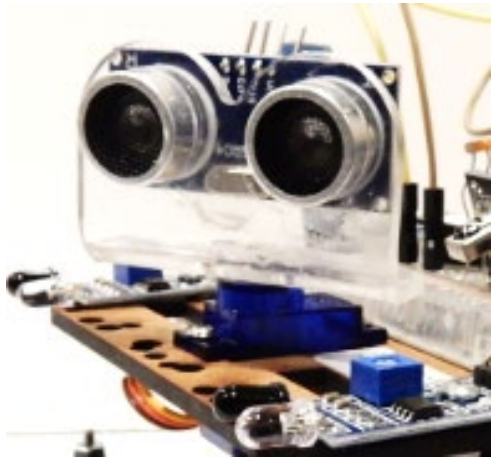


Completed Robot



Completed Robot





That's it!

Now we can start the experiments to learn how to program the robot with creative algorithms, motor control, basic electronics and sensor interfacing.

Please visit https://www.socalrobots.com/ **to download these exciting projects, includes videos and other training guides.**

Have FUN!