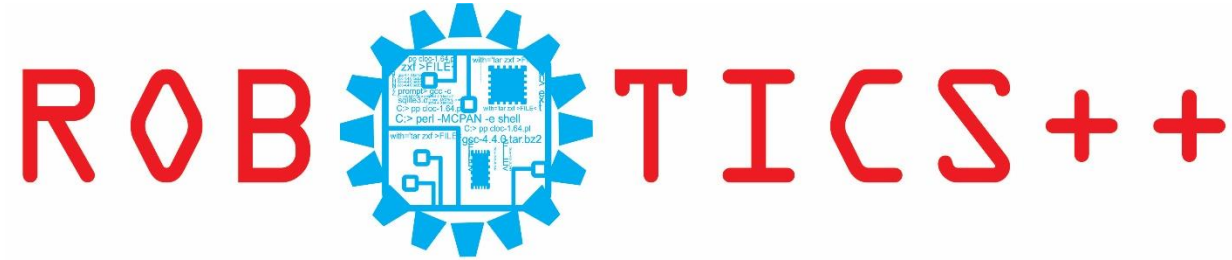
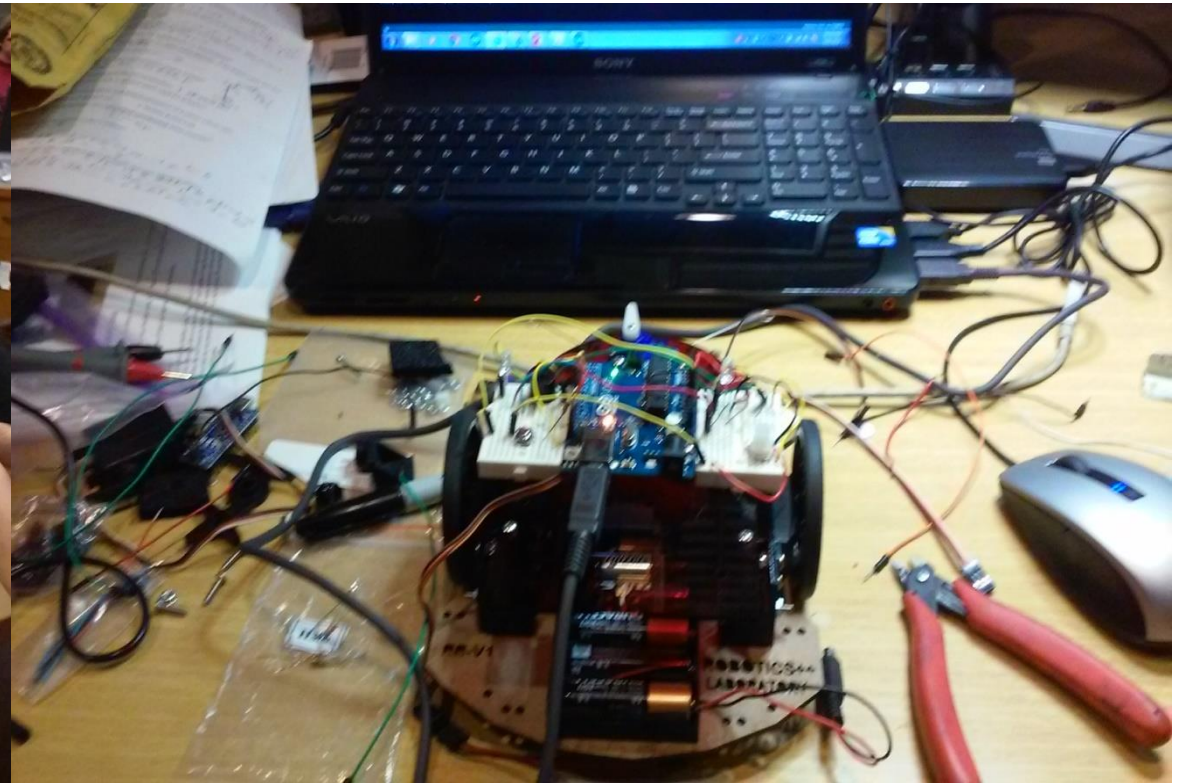


How to Build the Robotics++ V3 Robot



RESEARCH & EDUCATION
www.roboticsplusplus.com



All material and assembly guide can be downloaded from WWW.ROBOTICSITY.COM Pages Password : r2d2		
Note: Experiments are updated constantly with new sample programs, references and new sensors reviews.		
Robot Kit Version:	V3	
Update Date:	9/28/2016	
Part	Description	Qty
Sensors and CPU		
Arduino Uno R3	Arduino UNO R3 computer board with DC-DC converter	1
USB Programming Cable	USB Programming Cable	1
Arduino Sensor Shield V5.0	sensor shield to connect sensors, motors, LEDs	1
Micro Servo (blue colors) with screws	Micro Servo (blue colors) with screws	1
Sonar Sensor holder and screw	Sonar Sensor holder - spacer-glue and screws	1
Sonar Sensor HC-SR04	Sonar Sensor HC-SR04	1
360 Rotation Wheels Servo Motors	360 Rotation Wheels Servo Motors	2
Funduino Line Following Sensor	Funduino Line Following 3 IR Sensors	1
GY-521 MPU-6050 3-Axis 6DOF gyroscope + accelerometer board	GY-521 MPU-6050 3-Axis 6DOF gyroscope + accelerometer board	1
6 AA Battery Holder + on-off switch+cables	6 AA Battery Holder + on-off switch+cables	1
10K potentiometer	10K potentiometer	1
IR Remote Control with RX/TX+TX LED+cables	IR Remote Control with RX/TX+TX LED+cables	1
LEDs	LEDs - colors vary	4
CDS light analog sensor	CDS light analog sensor	1
IR adjustable Distance Sensors	IR adjustable Distance Sensors	2
Tactile momentary ON switches	Tactile momentary ON switches	2
1 kΩ Resistors	1 kΩ Resistors	2
10 kΩ Resistors	10 kΩ Resistors	4
220 Ω Resistors	220 Ω Resistors	8
Piezospoker	Piezospoker	1
Feelers (momentary ON, long switches)	Feelers (momentary ON, long switches)	2
Bluetooth HC05 or HC06 passcode 1234	Bluetooth HC05 or HC06 passcode 1234	1
DC-DC step down converter	DC-DC step down converter	1
Bonus Sensor	Humidity analog sensor	1
Hardware & Brackets		
Upper Deck Chassis	lasercut upper deck chassis	1
Lower Deck Chassis	lasercut lower deck chassis	1
Wheels Servo Holder	lasercut servo holder for wheels	2
Servo metal L Brackets	servo metal L brackets	4
Wheels+screws	Wheels+screws	2
4-40 X1/2" pan head screws for servos, front acorn, line IR	4-40 X1/2" pan head screws for servos, front acorn, line IR	13
4-40x1" flathead or panhead Screw for line following sensor	4-40x1" flathead or panhead Screw for line following sensor	2
4-40 X3/8" screws for L brackets and spacers	4-40 X3/8" screws for L brackets and spacers	8
4-40 X1/4" pan head screws	4-40 X1/4" screws for upper deck, Arduino	10
Nylon Spacers 4-40	Nylon Spacers 4-40 to mount Arduino	3
4-40x3/4 Screws	4-40x3/4" Screws feelers/switches	4
4-40x3/4" flathead Screw for back of battery pack	4-40x3/4" flathead Screw for back of battery pack	1
4-40 Metal Hex Nut	4-40 Metal Hex Nut	23
4-40 plastic nuts for IR sensors	4-40 plastic nuts for IR sensors	2
4-40 Acorn Nuts	4-40 Acorn Nuts	2
4-40x1.5 Hex Aluminum Spacers	4-40x1.5" Hex Aluminum Spacers	4
Dupont Wires Male/Male	Dupont Wires M/M	8
Dupont Wires Female/Female	Dupont Wires F/F	15
Dupont Wires Male/Female	Dupont Wires M/F	8
Breadboard - 400 tie points	Breadboard - 400 tie points	1
4-40x1" Screw for breadboard and line following sensor	4-40x1" Screw for breadboard and mount line following sens	3
Screwdrivers mini flat and/or star	Screwdriver mini flat and/or star	2
Sumo lasercut ramp	Sumo lasercut ramp	1
Plastic L bracket for sumo ramp	Plastic L brackets for sumo ramp	2
Robot Container ship box , sticker, flyer	Robot Container ship box , sticker, flyer	1
Electronics 101 parts - for the extra 10 experiments		
See http://www.roboticscity.com/electronics101.html		
DC 5v motor	3-6VDC motor	1
Diode 1Nxxxx	Diode 1Nxxxx	1
Extra LEDs	Extra LEDs - various colors	4
Relay	Relay	1
2N2222 or 2N3904 Transistor - please check before connecting	2N2222 or 2N3904 Transistor - please check before connecting	1
74HC595N shift register	74HC595N shift register	1

Put your screws on this template to help you inventory and determine size



1.5" Hex
Aluminum
Spacers

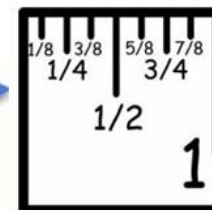
Acorn Nuts



3/4" pan head
screws (4)



Ruler to Scale



1/4" pan
head
screws (10)



1/2" pan
head
screws (13)



Servo
metal L
Brackets



Nylon Spacers



3/8" pan
head
screws (8)



3/4" flat
head
screw(1)

Locking
metal
nuts

(23)



Nylon nuts
for IR
sensors

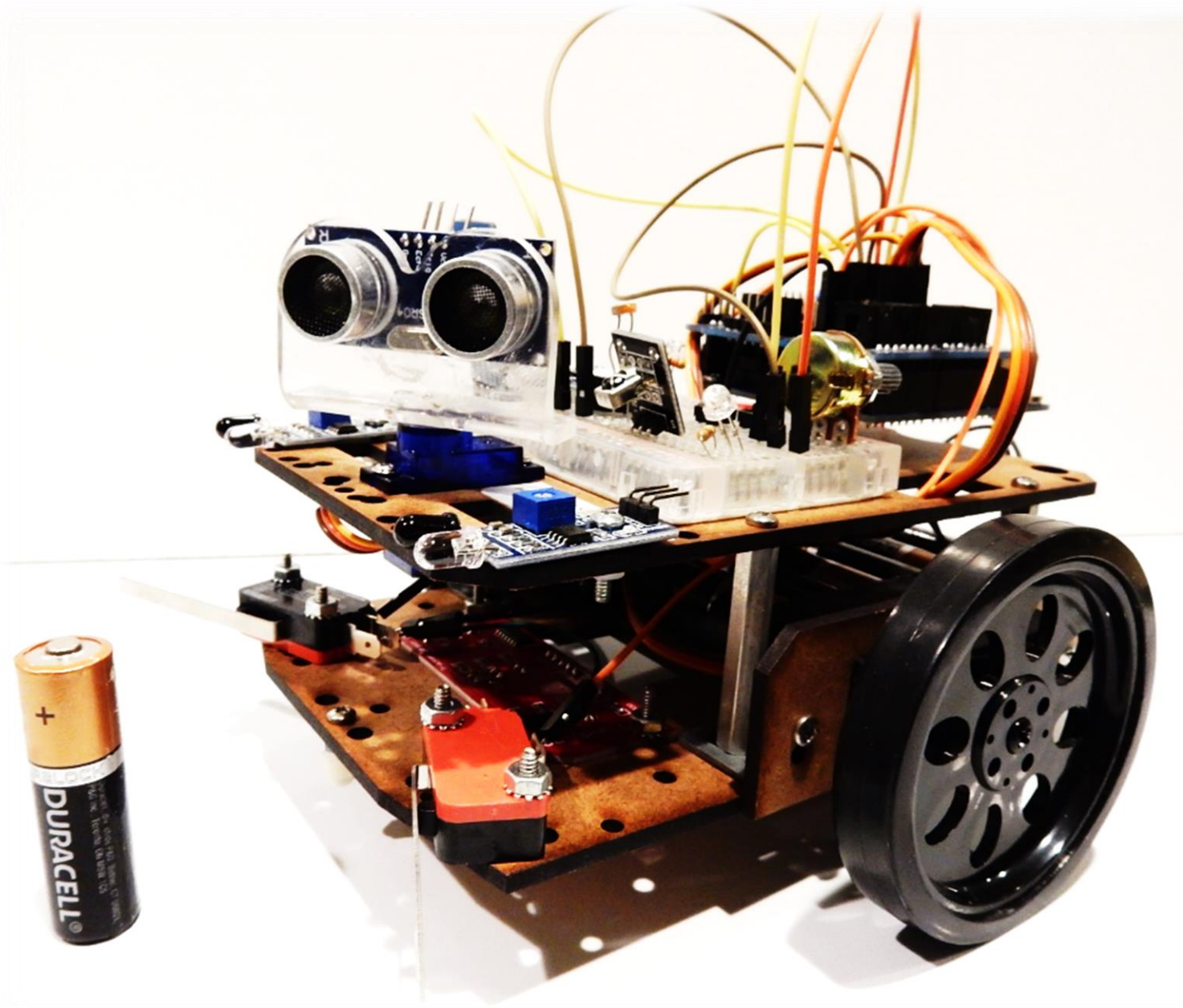


Screwdrivers
mini flat and
star



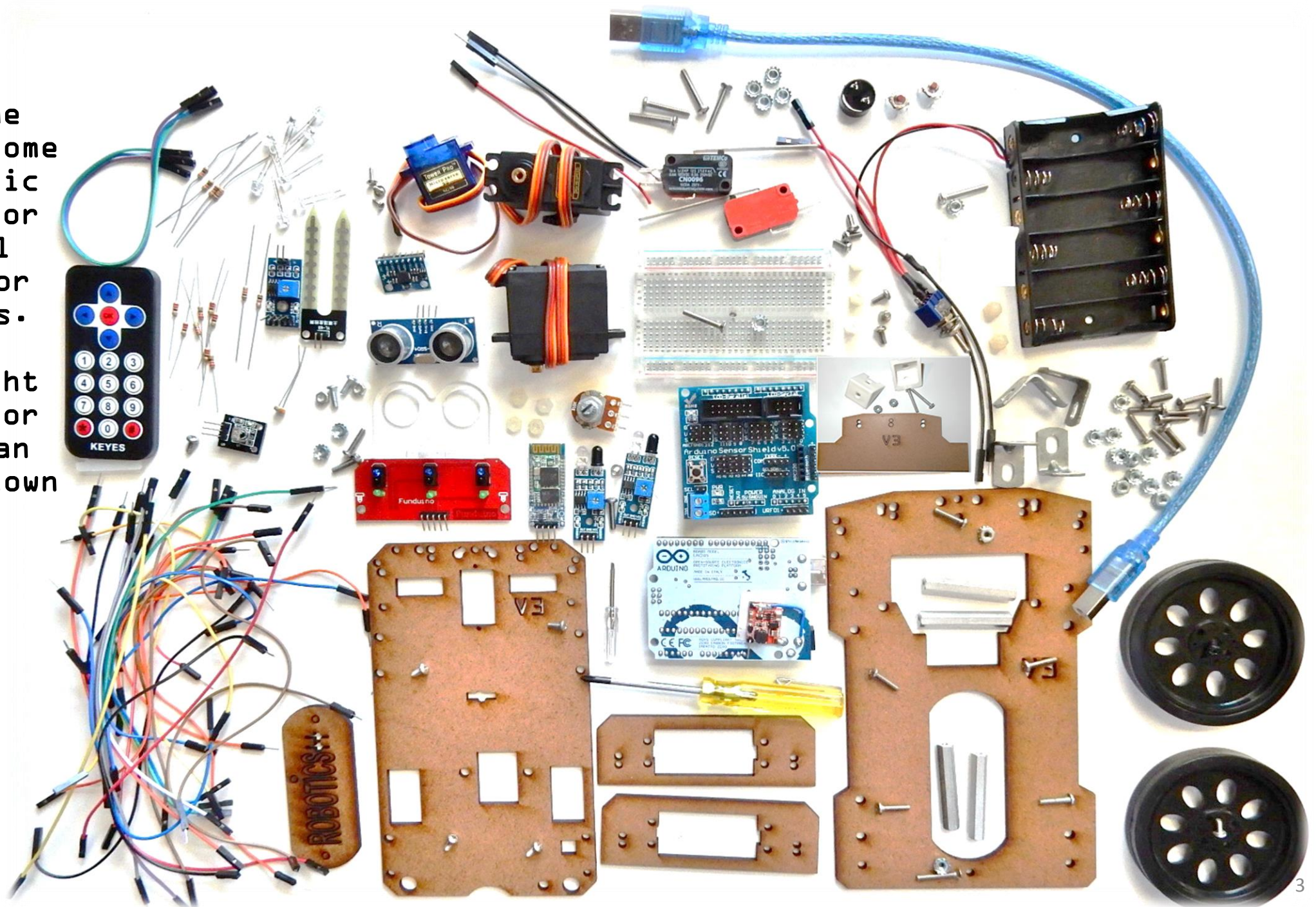
Completed Robotics++ V3 Robot.
More views of completed robot
can be found at the end of
this instructions manual

The fun starts now!

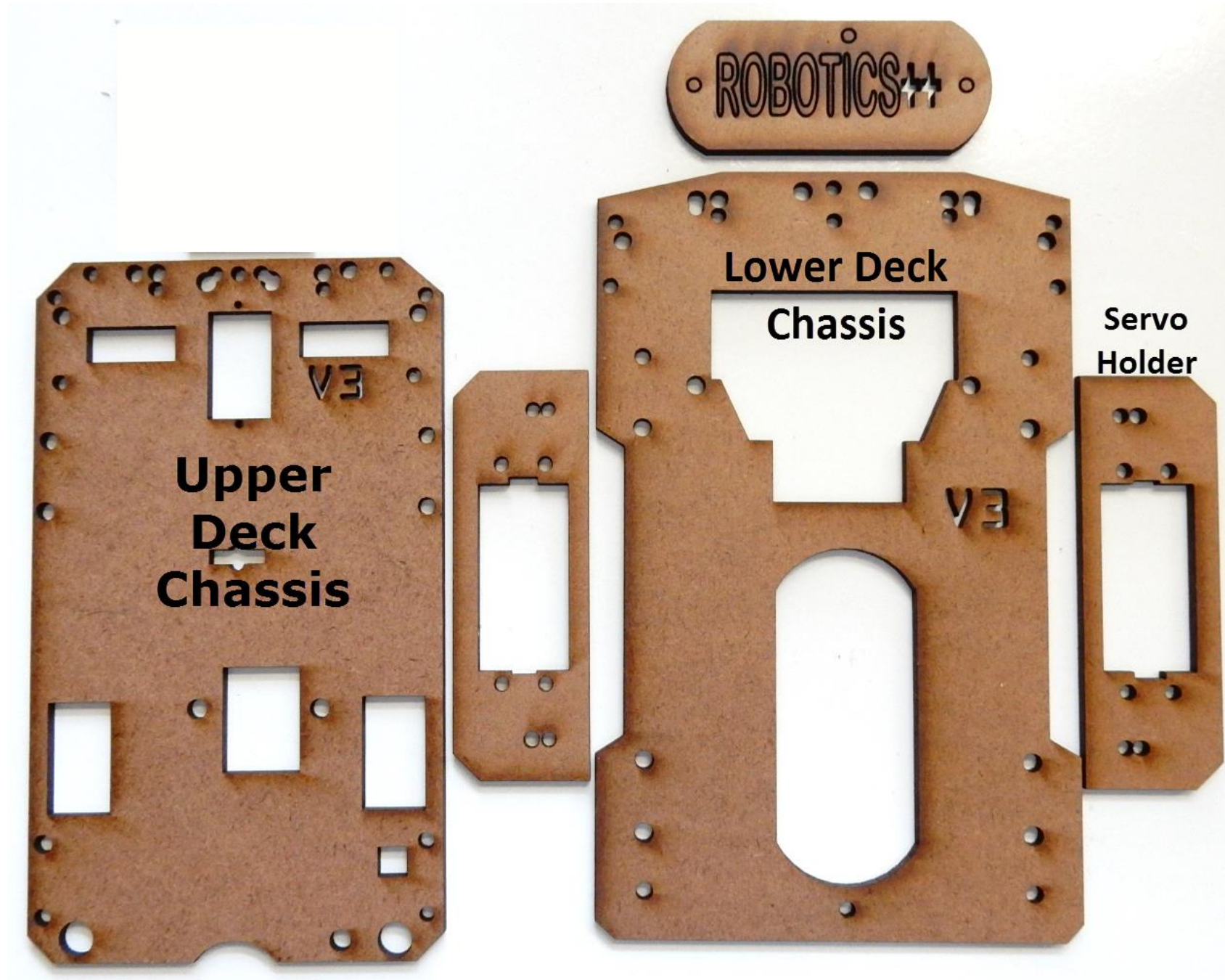


V3 Kit Parts

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



Wheels+screwsWheels+screws



Breadboard + flat
head screw and nut



Micro Servo (blue
color) with screws



Sonar Sensor
holder and
screws



6 AA Battery Holder + on-
off switch+cables



Graphical Parts List

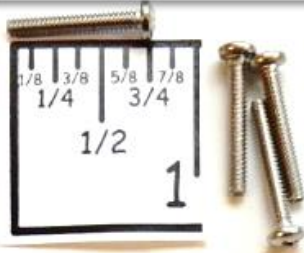


1.5" Hex Aluminum Spacers

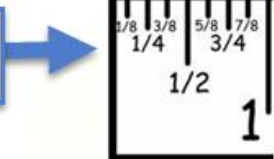
Acorn Nuts



3/4" pan head screws (4)



Ruler to Scale



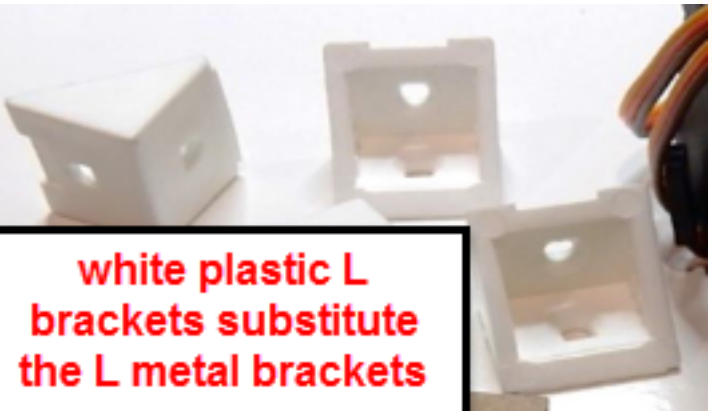
1/4" pan head screws (10)



Servo metal L Brackets



1/2" pan head screws (13)



white plastic L brackets substitute the L metal brackets

Nylon Spacers



3/8" pan head screws (8)



3/4" flat head screw (1)

Locking metal nuts (23)



Nylon nuts for IR sensors



Screwdrivers mini flat and star



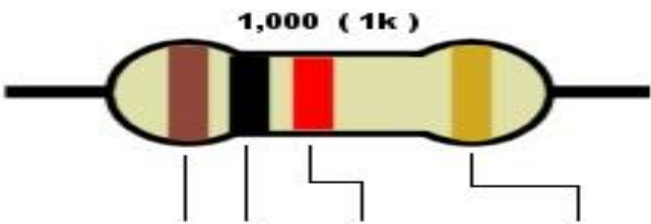
Graphical Parts List

Resistors color code:

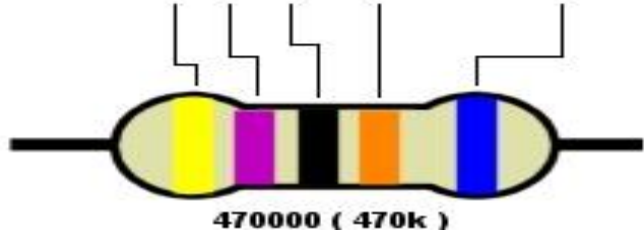
220 Ohm – Red, Red, Brown

1K Ohm- Brown, Black, Red

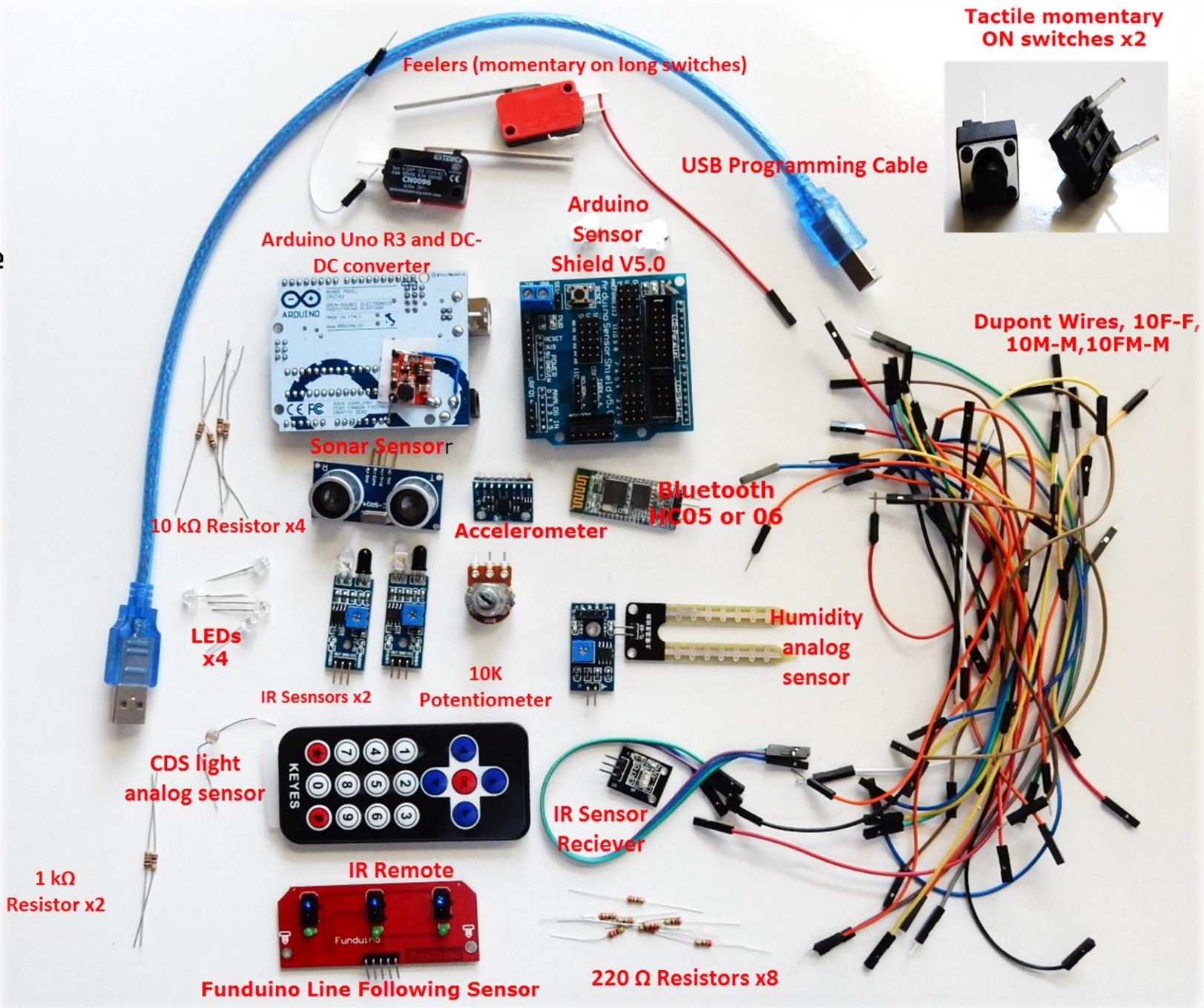
10K Ohm – Brown, Black, Orange



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%

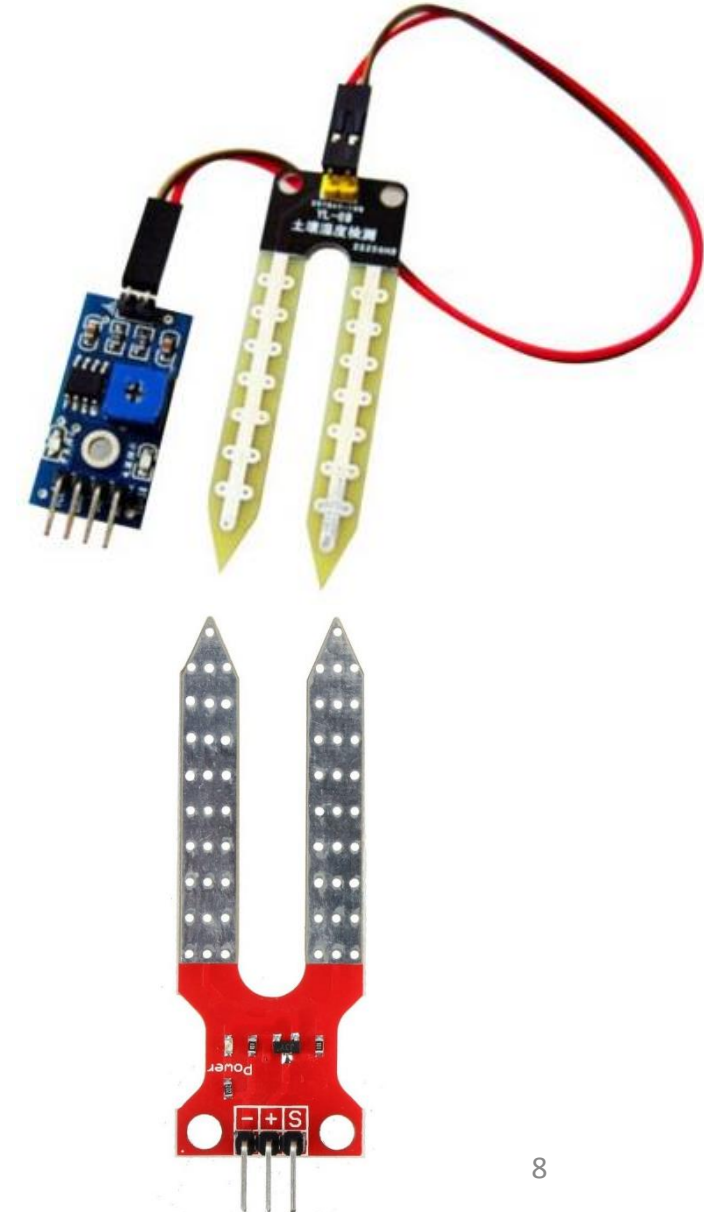
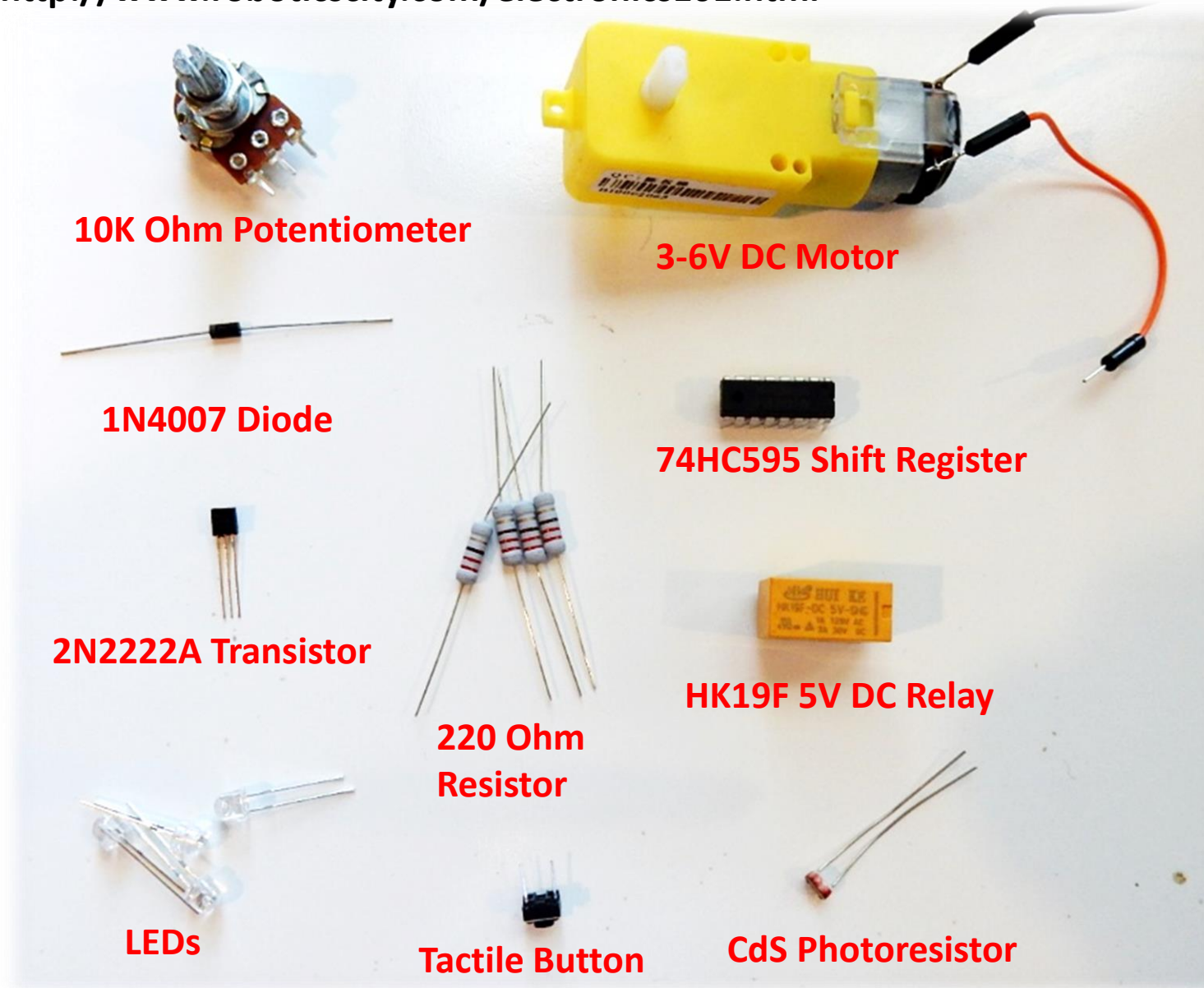


Potentiometer is 10K Ohm



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



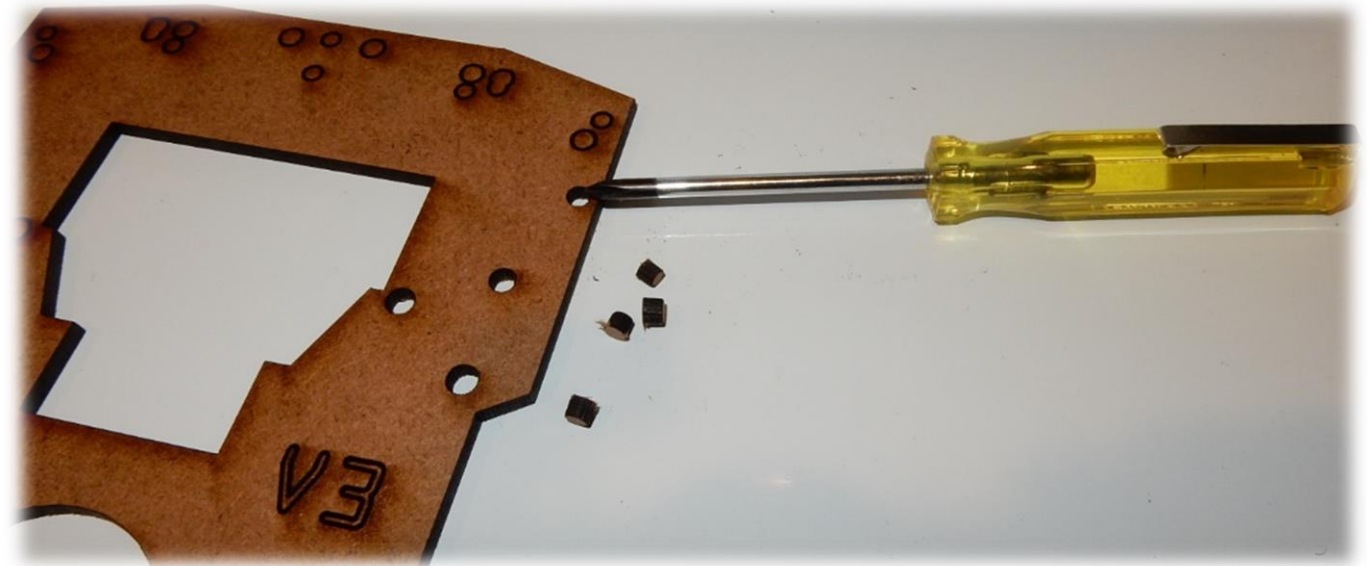
Graphical Parts List



SUMO Parts:

- (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.

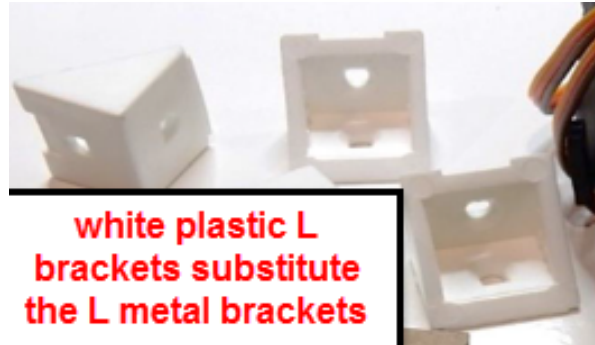


Step 1: Assembling the Servo Motors

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



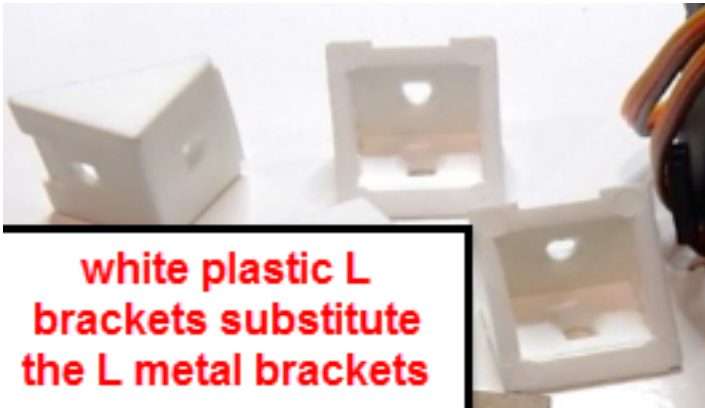
white plastic L
brackets substitute
the L metal brackets



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



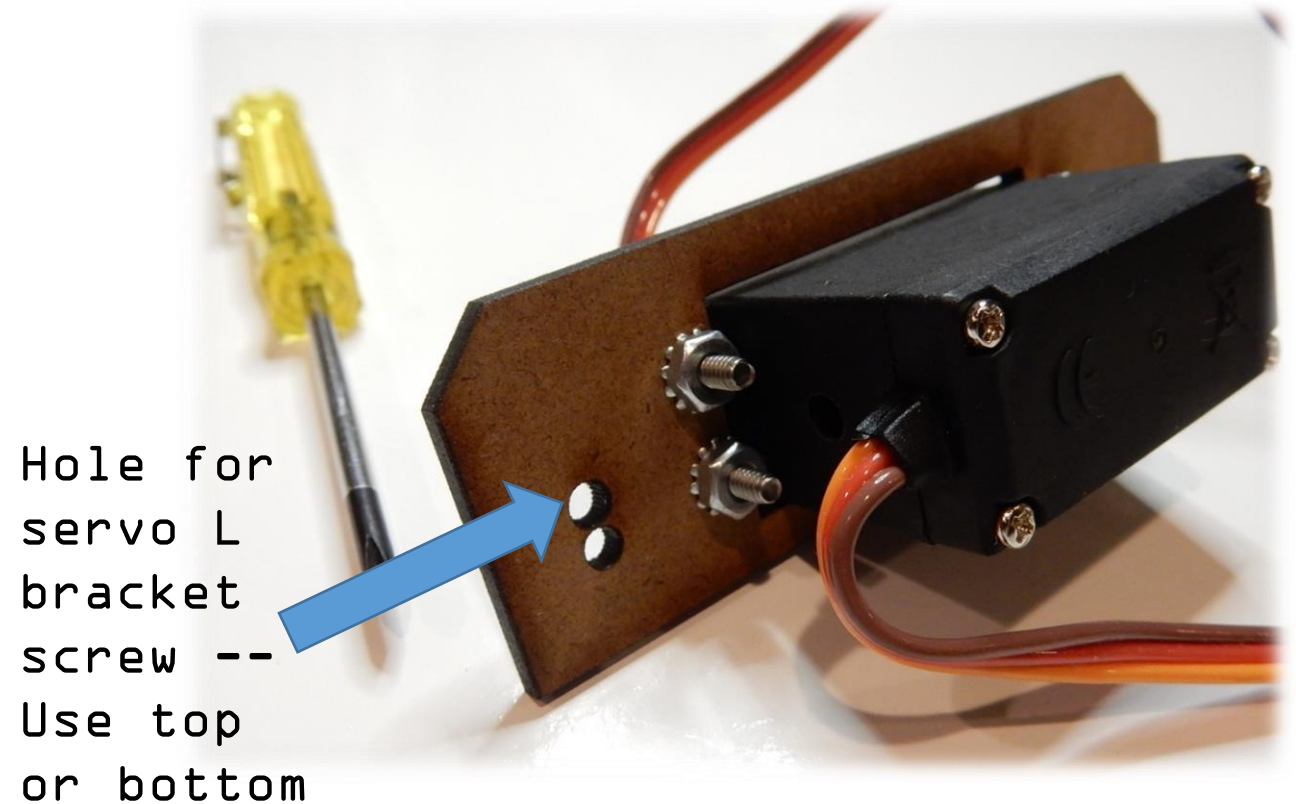
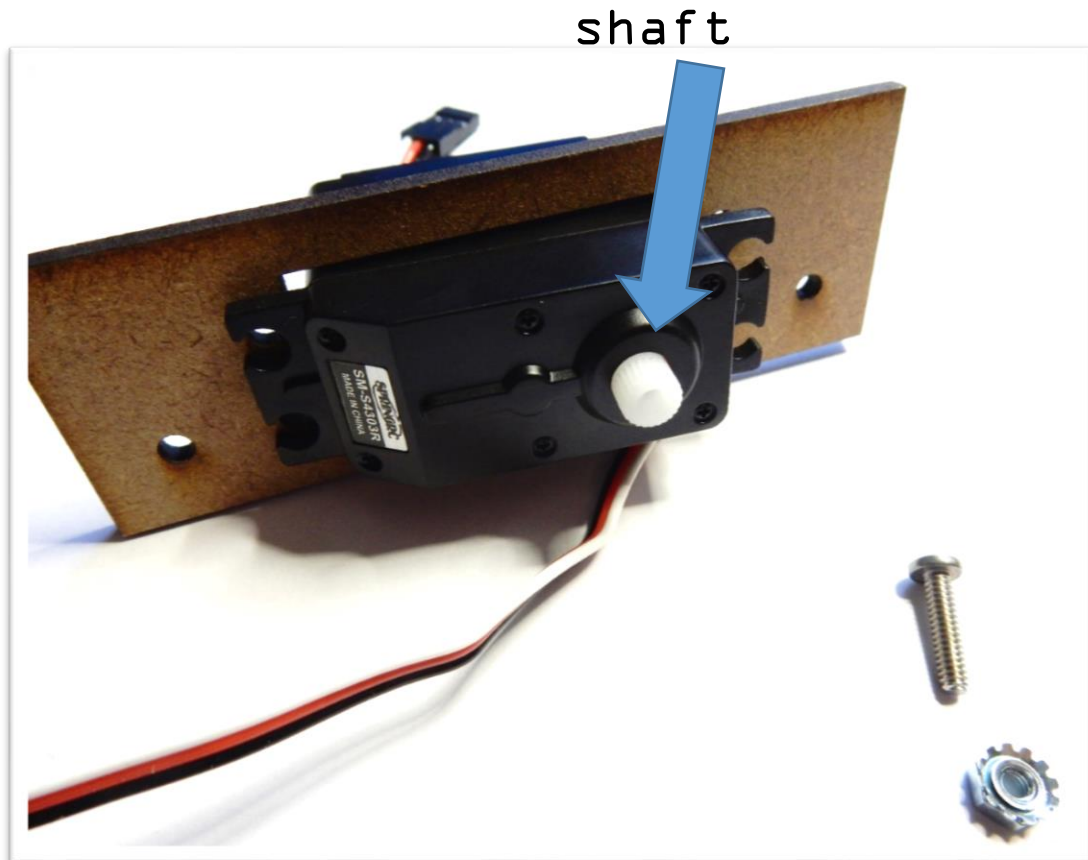
white plastic L
brackets substitute
the L metal brackets



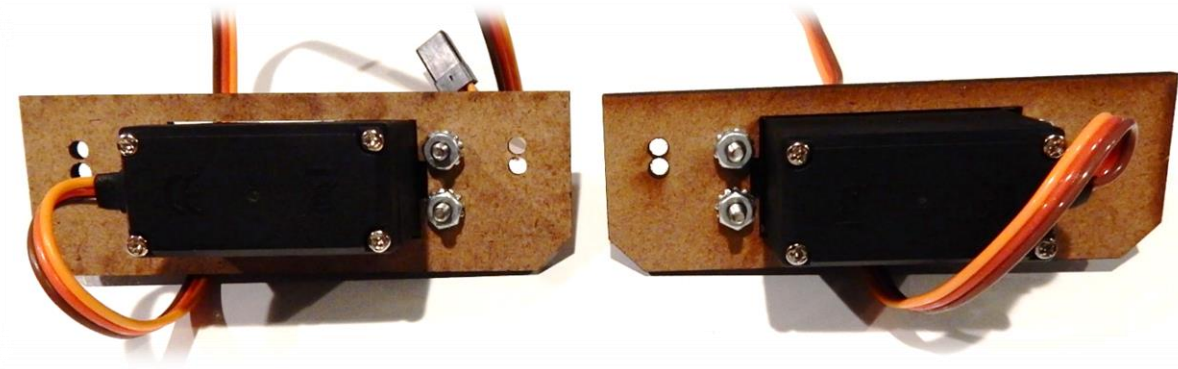
Insert the servo motors into the servo holders and secure them with the 1/2" screws and nuts as shown on the right photo.

Please take careful note and on the next page:

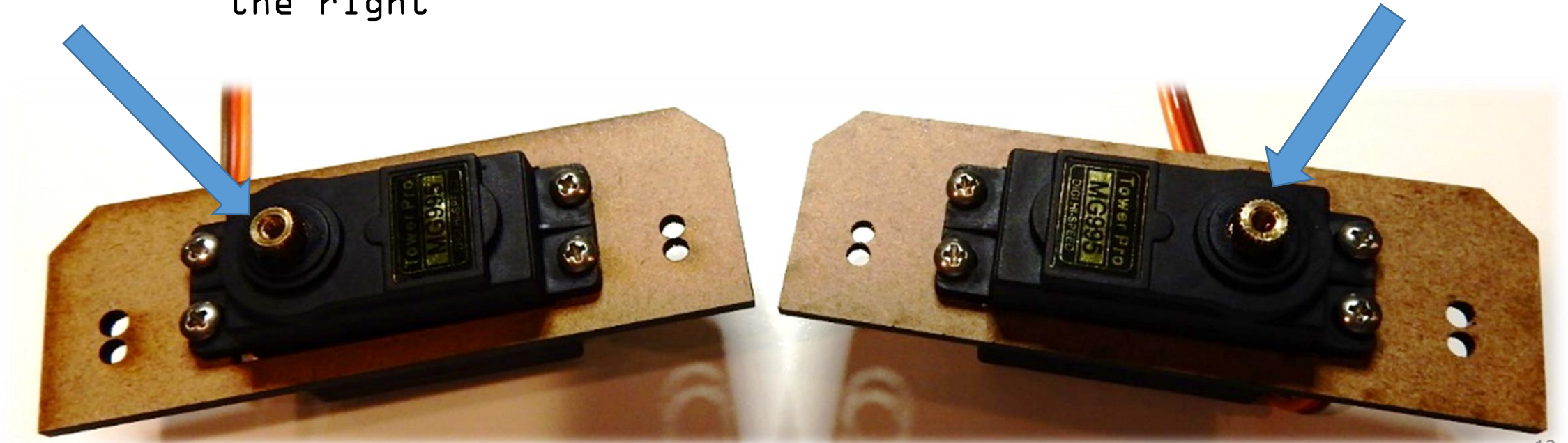
- how the motors are inserted into the servo holders
- how the screws face in on the servo holders
- how the shaft of the motor is facing on the front on both left and right sides.



Backside of servo assemblies



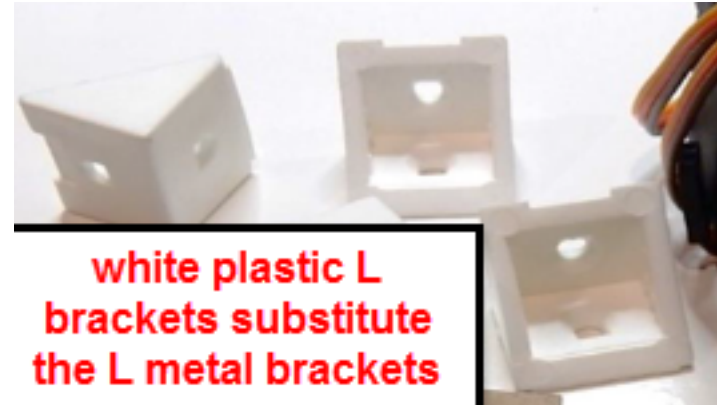
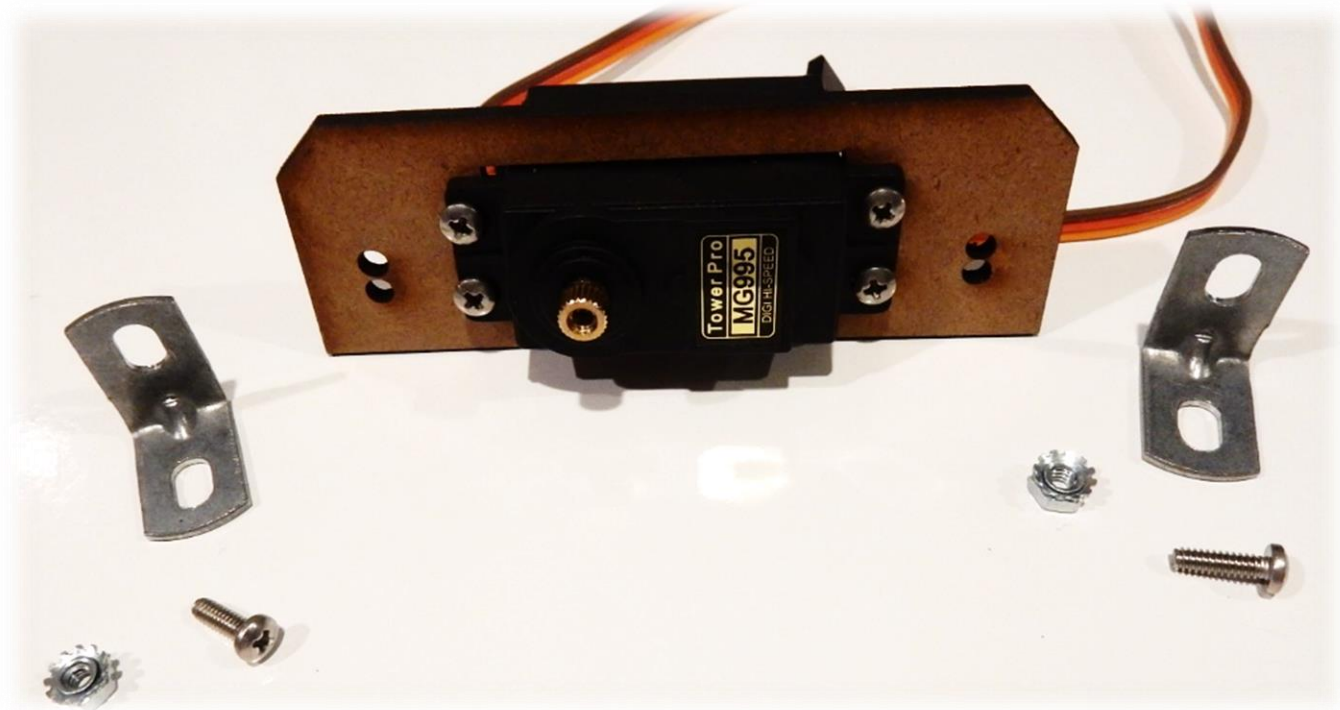
Notice how the position of the shaft on each servo holder is on opposite ends. One will be on the left and the other on the right



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

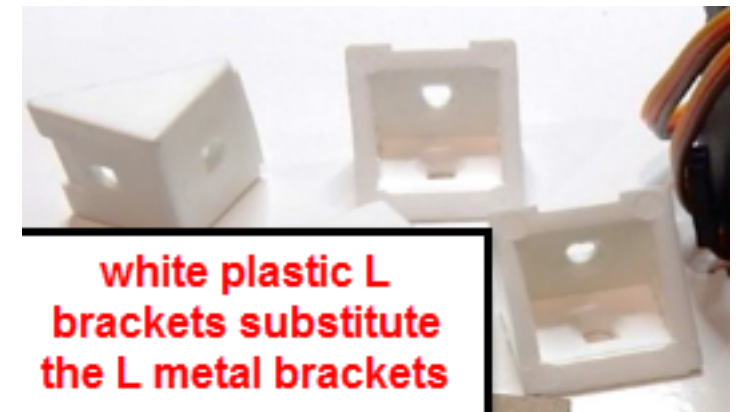
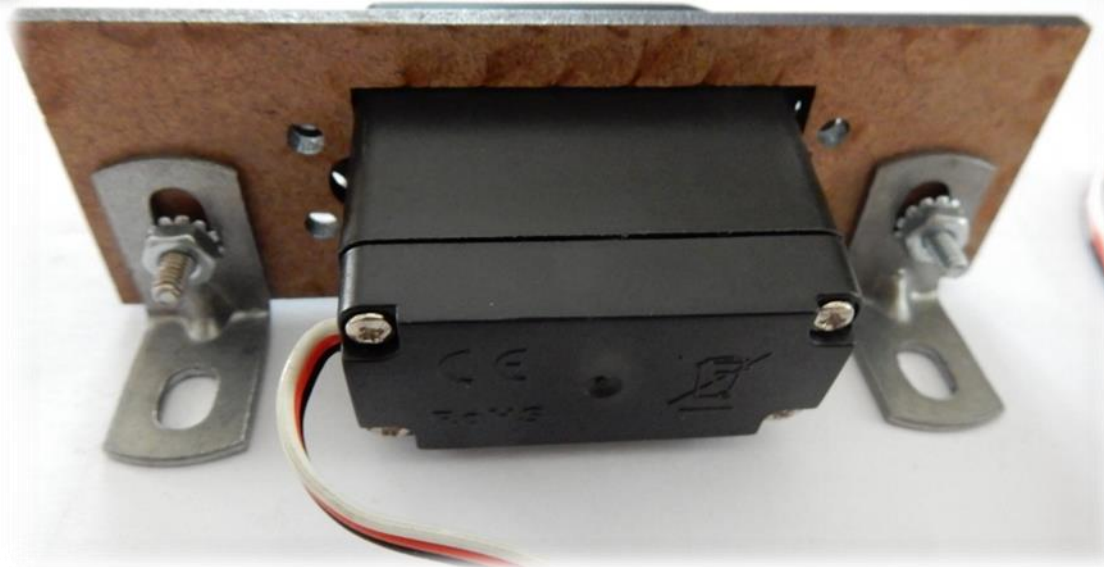
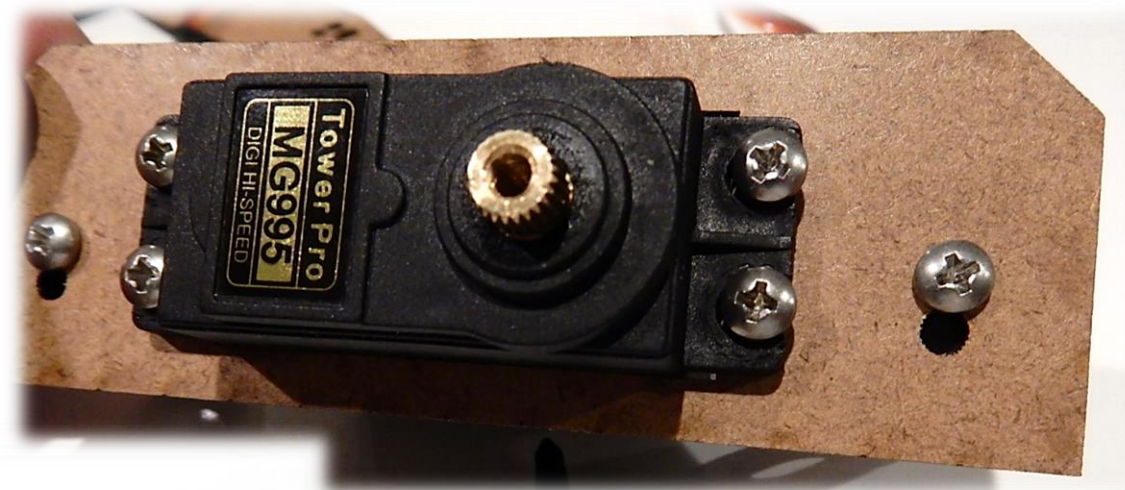
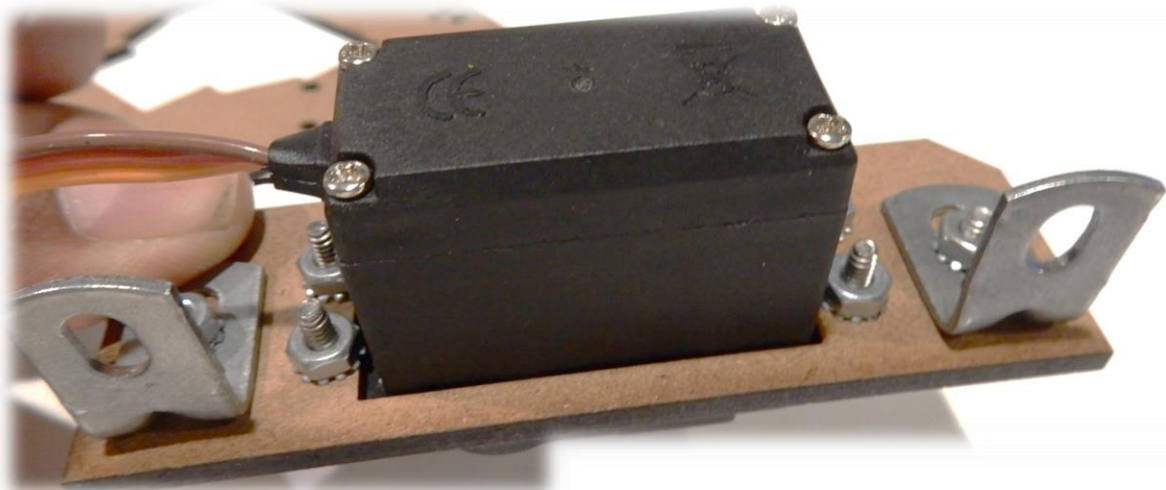
Parts:

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



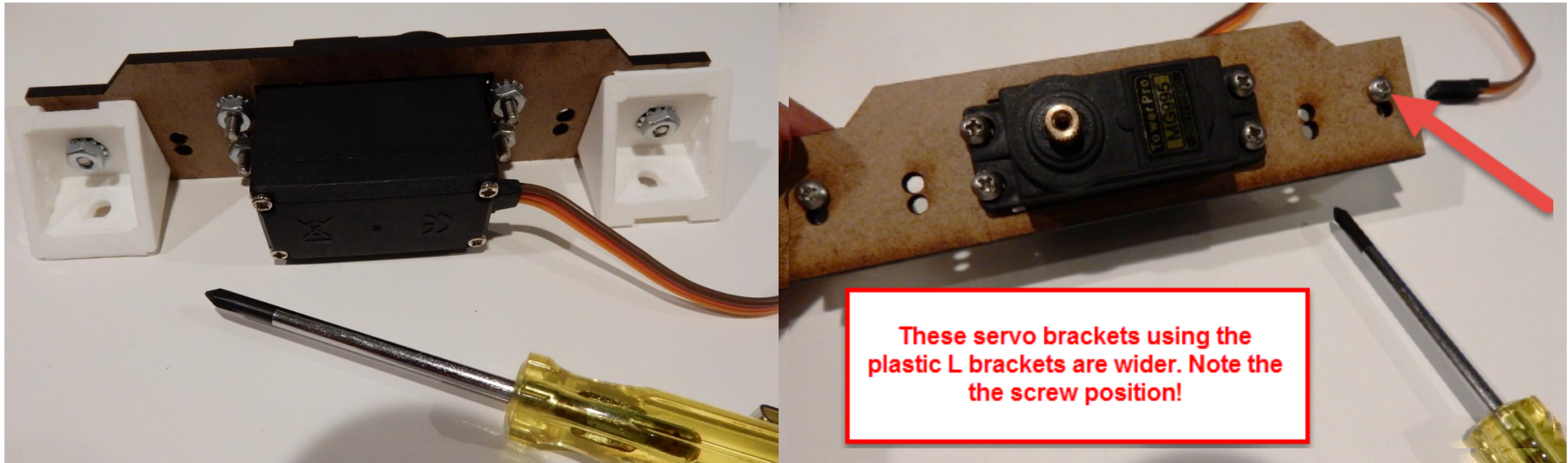
white plastic L
brackets substitute
the L metal brackets

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.



white plastic L
brackets substitute
the L metal brackets

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



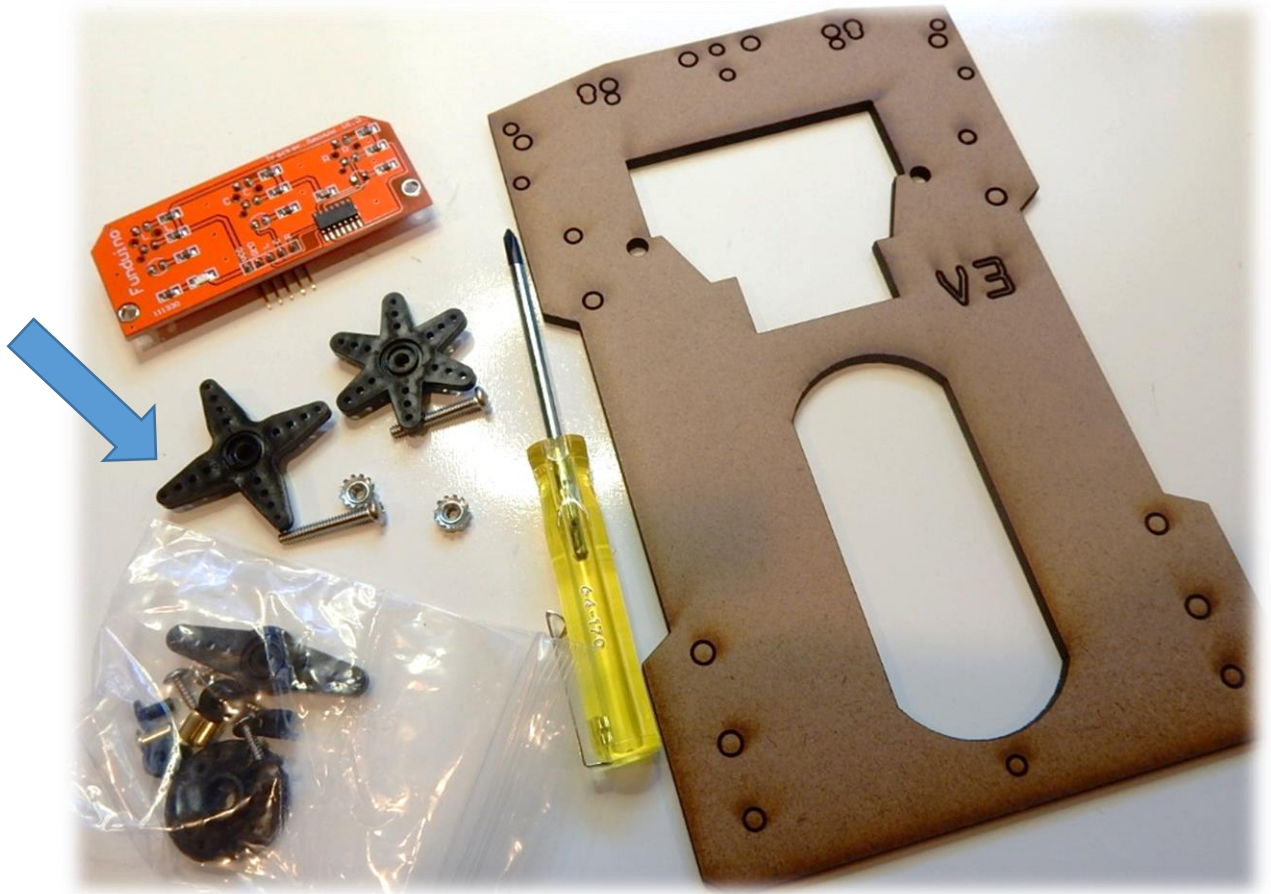
Step 3: Assembling the Line Following Sensor

Parts:

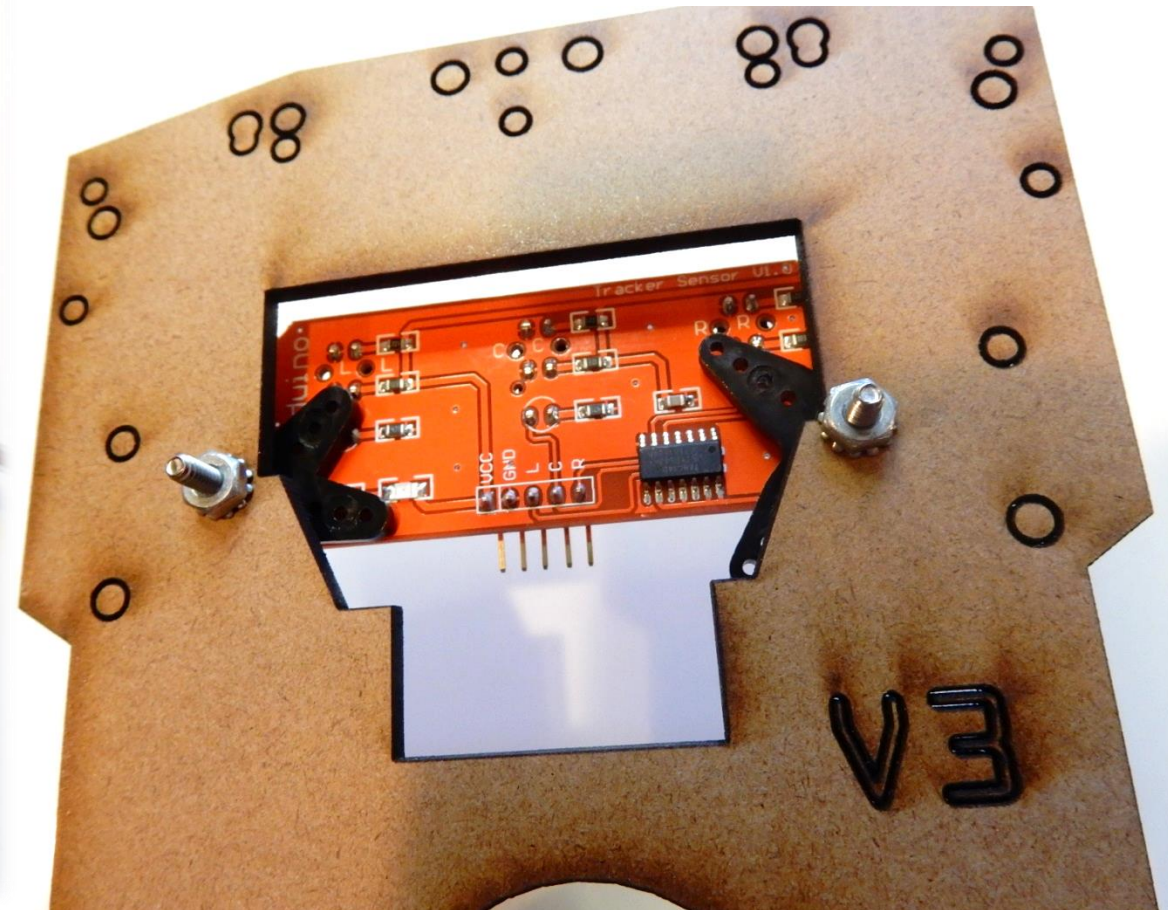
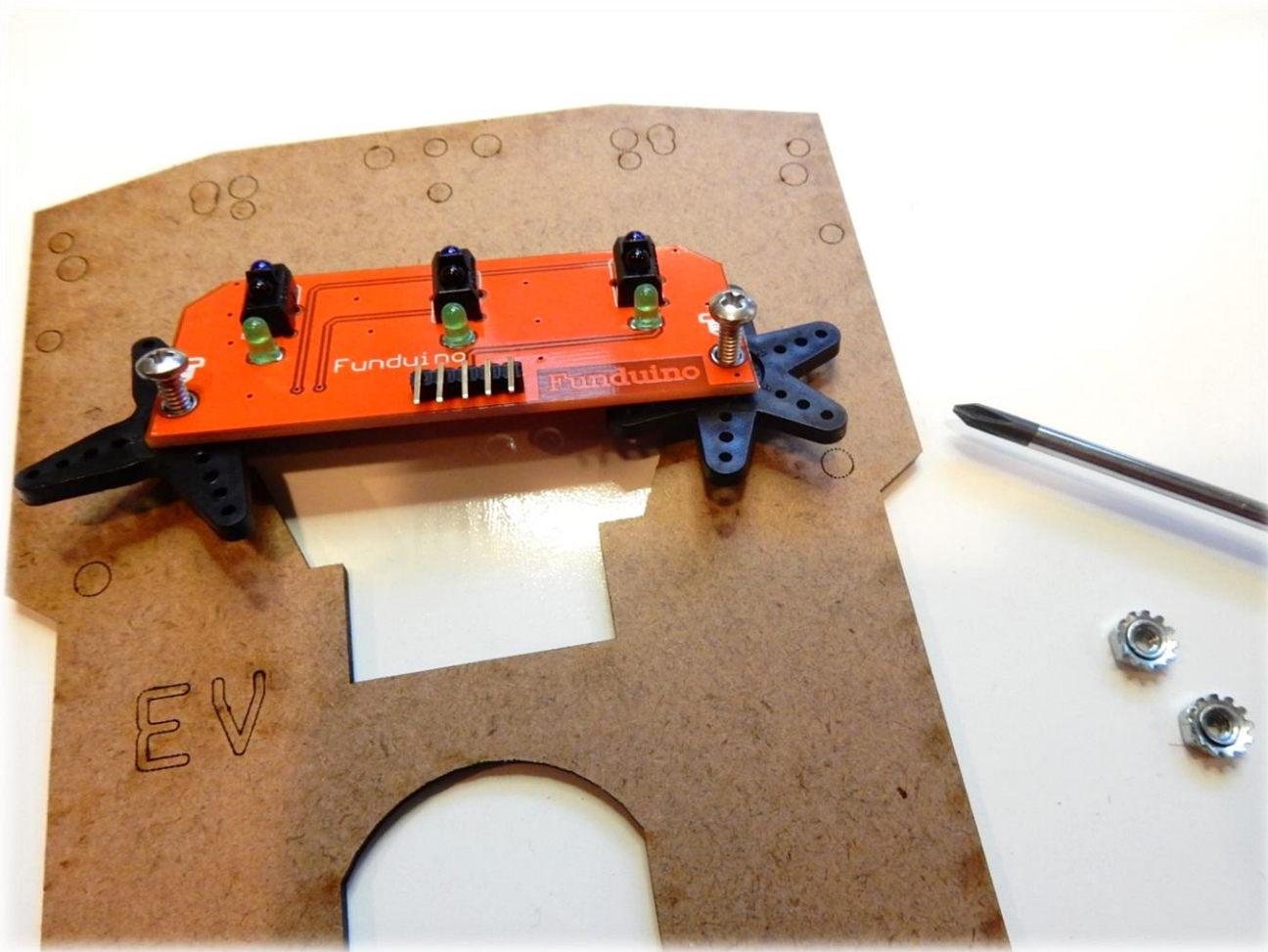
(2) metal locking nuts
(2) 3/4 screws
Red line following sensor
Lower laser cut chassis
star screwdriver
Servo horns from one of your 360 rotation servos

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

Servo
Horns



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



Step 4: Assembling the "Feeler" (switches) Sensors

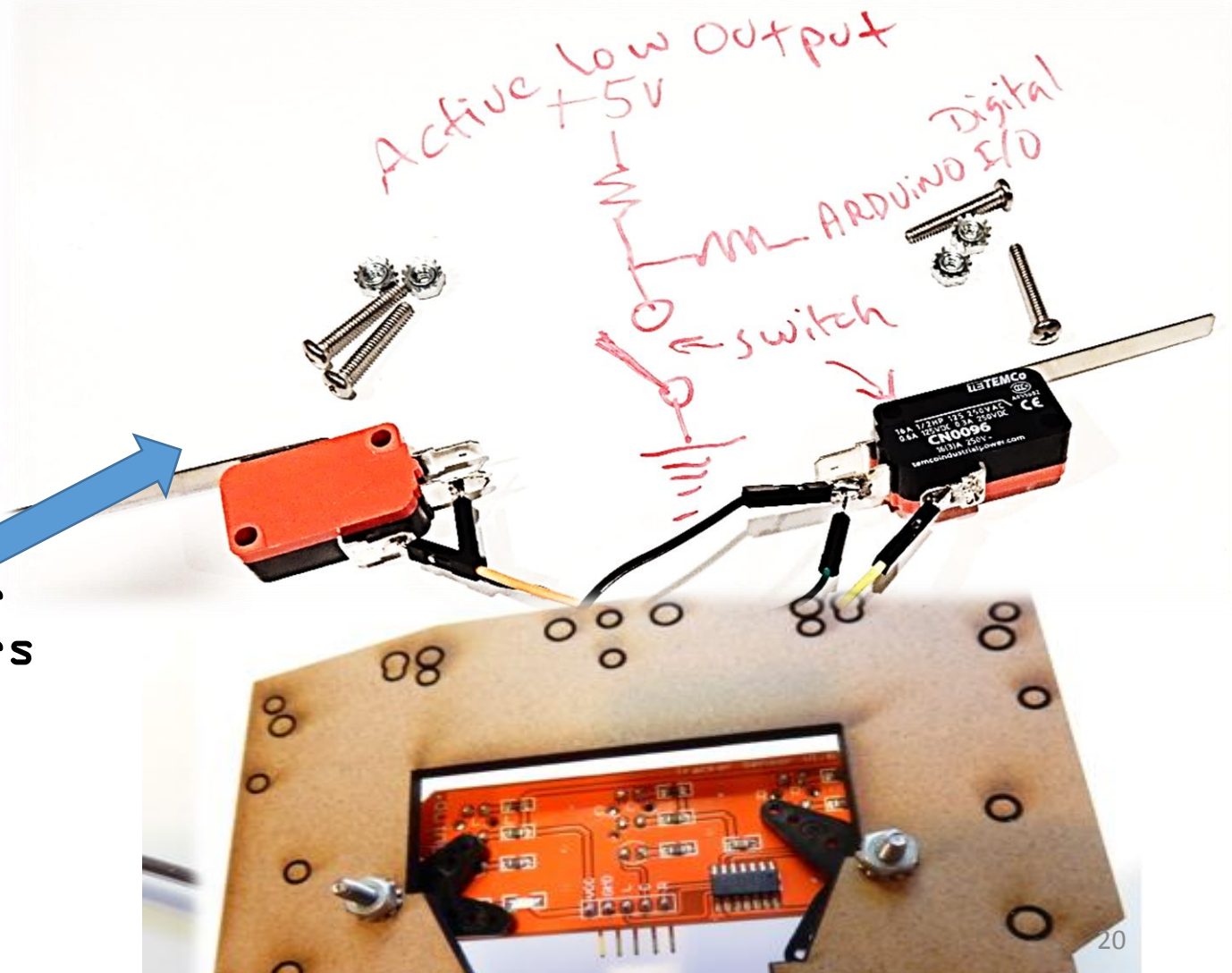
The feeler sensors are mechanical momentarily ON switches that when pressed it completes the circuit and can trigger a response. These are secondary sensors in case our other sensors do not work.

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

Parts:

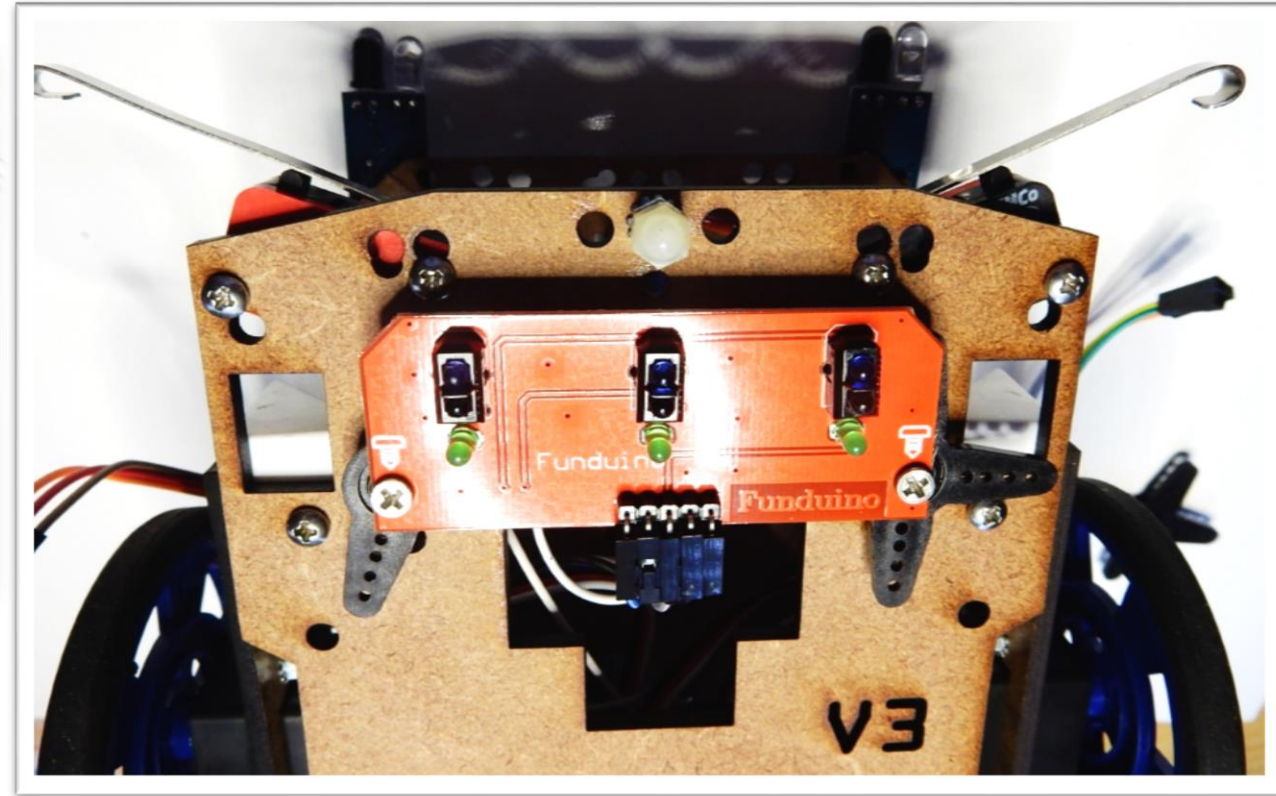
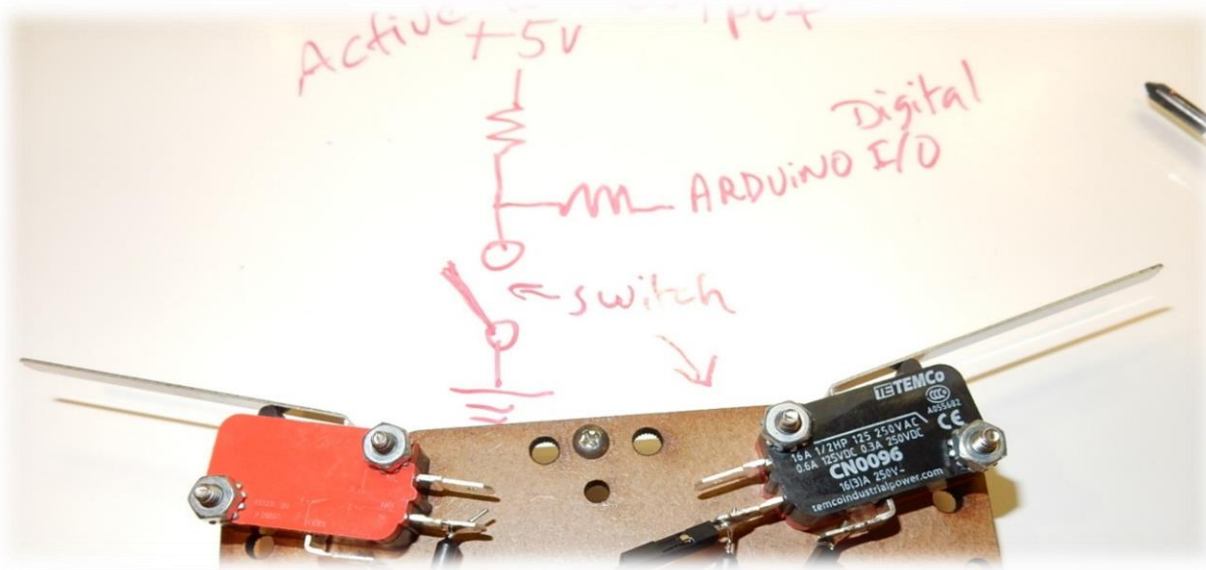
- (4) 3/4" flat head screws
- (4) lock nuts
- (2) Feelers momentarily ON switches (prewired)
- Star screwdriver
- (1) Lower chassis

Feeler
Sensors



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

Pay attention to the angles the switches are positioned at

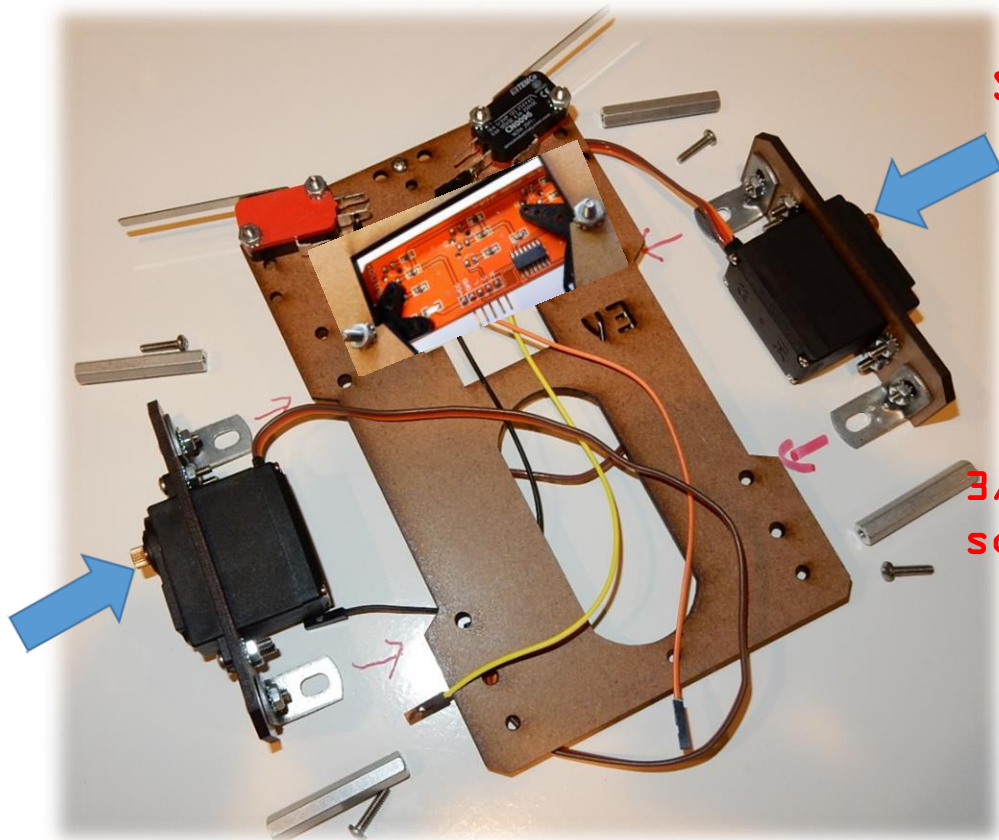


Step 5: Assembling the servo motors on lower chassis

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



Servo Motor Shaft

3/8" panhead screws

Use 3/8" panhead screws here

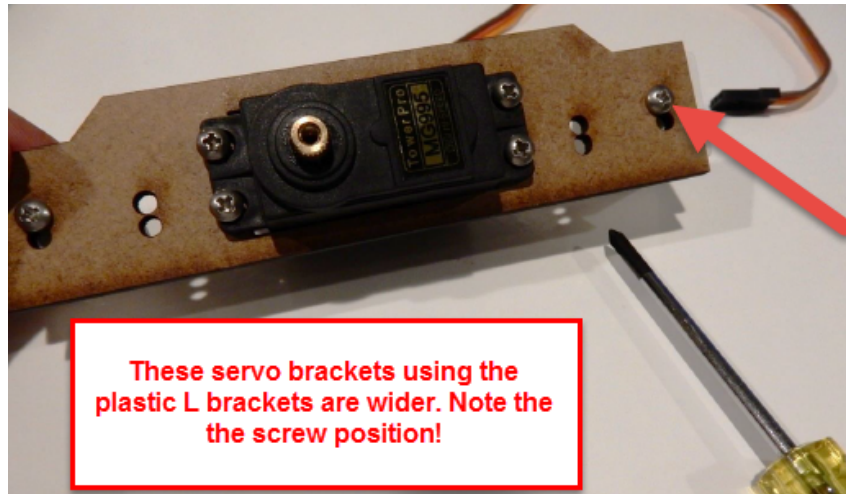
Use 3/8" panhead screws here

Servo Motor Shaft

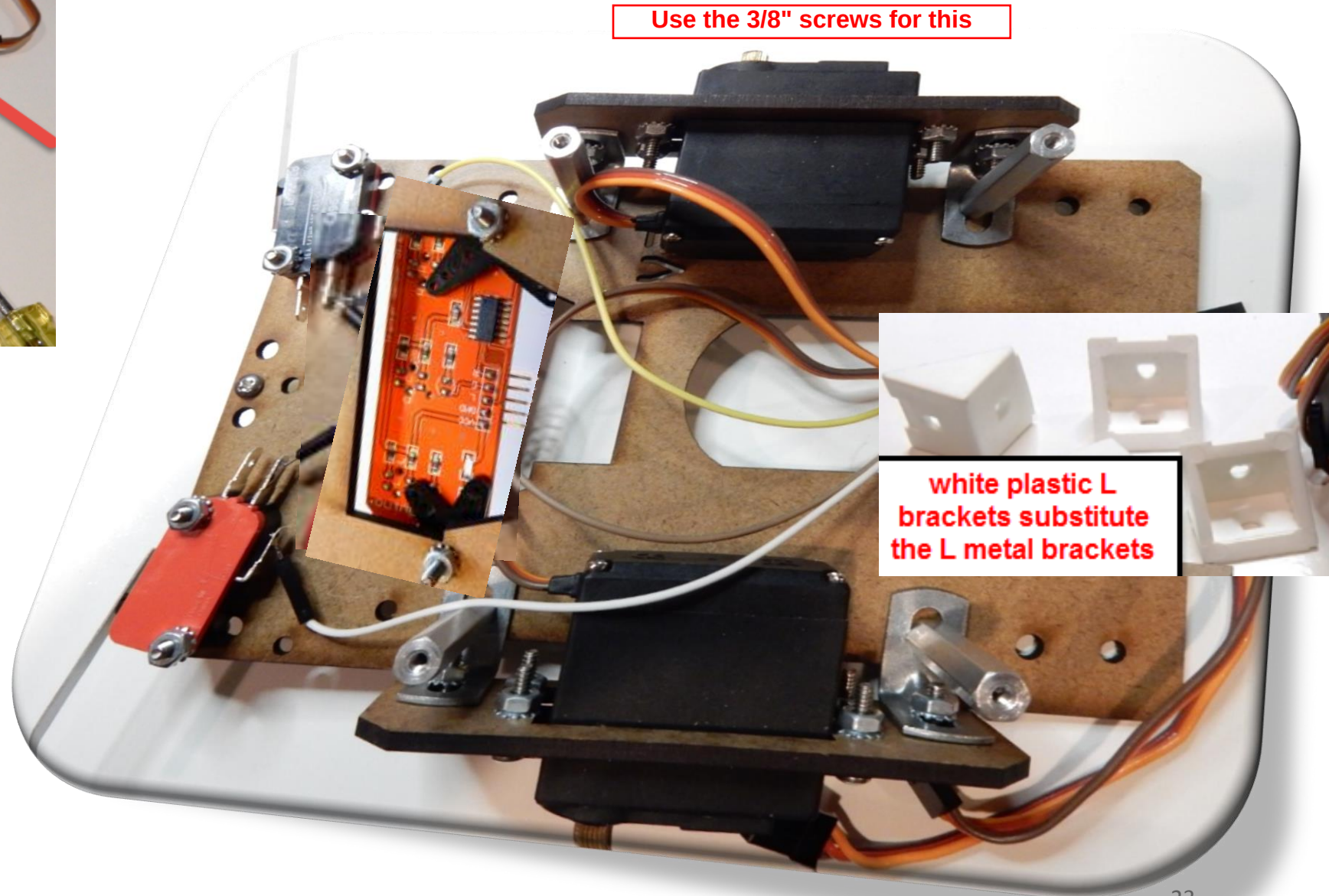
Attention!

Servo shaft points to the front of the chassis

Metal spacers assembled lower chassis



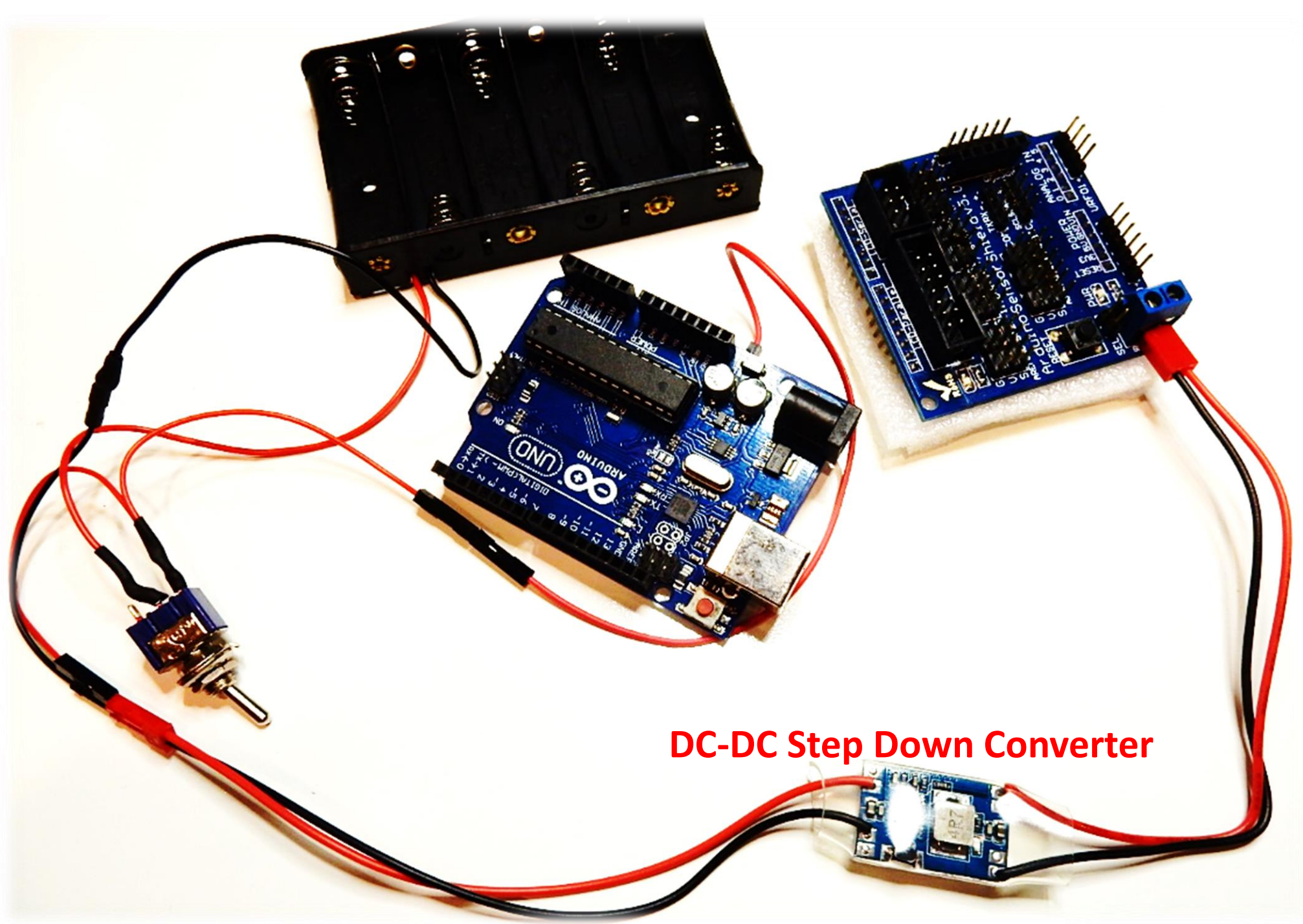
Attention! don't make it too tight yet as you need to assemble the upper chassis on top and might require some alignment adjustments. Make sure servo shaft points to the front of chassis



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 stabilize 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.

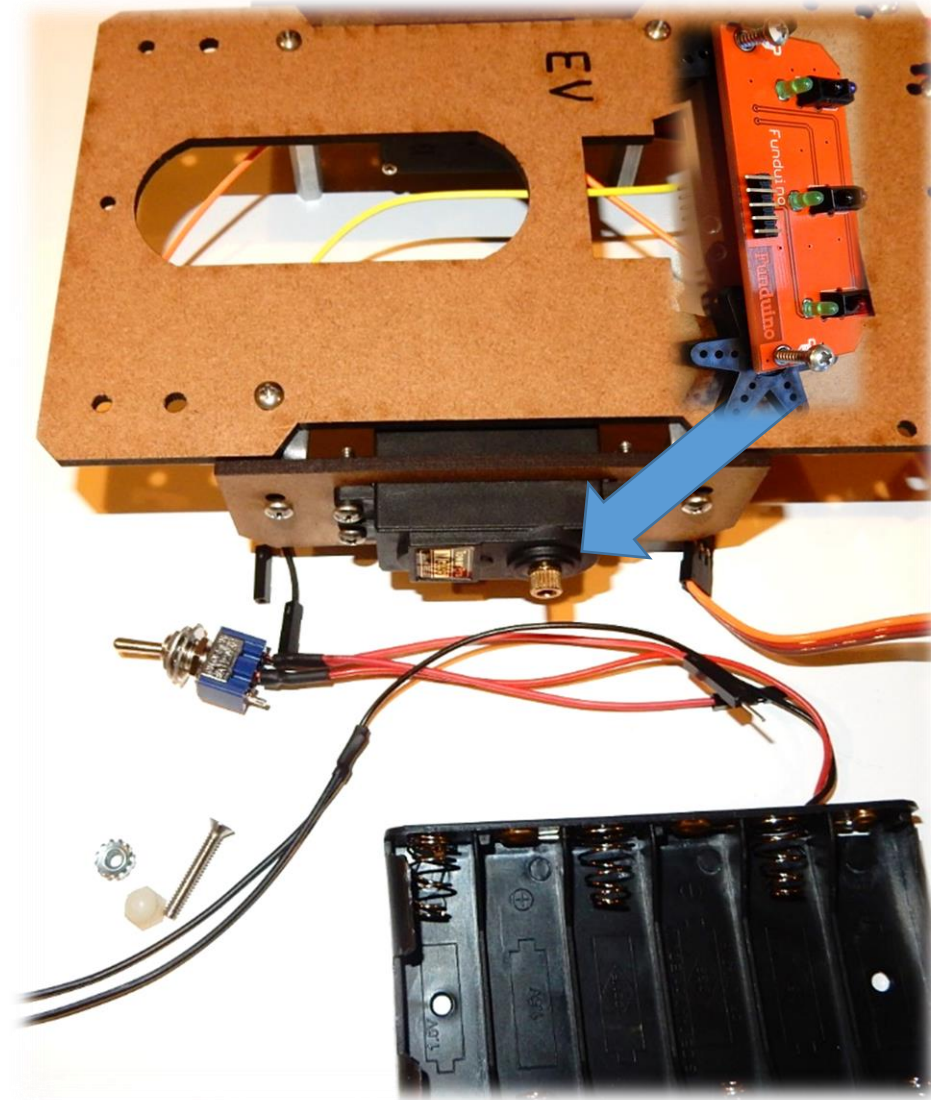


DC-DC Step Down Converter

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

Parts:

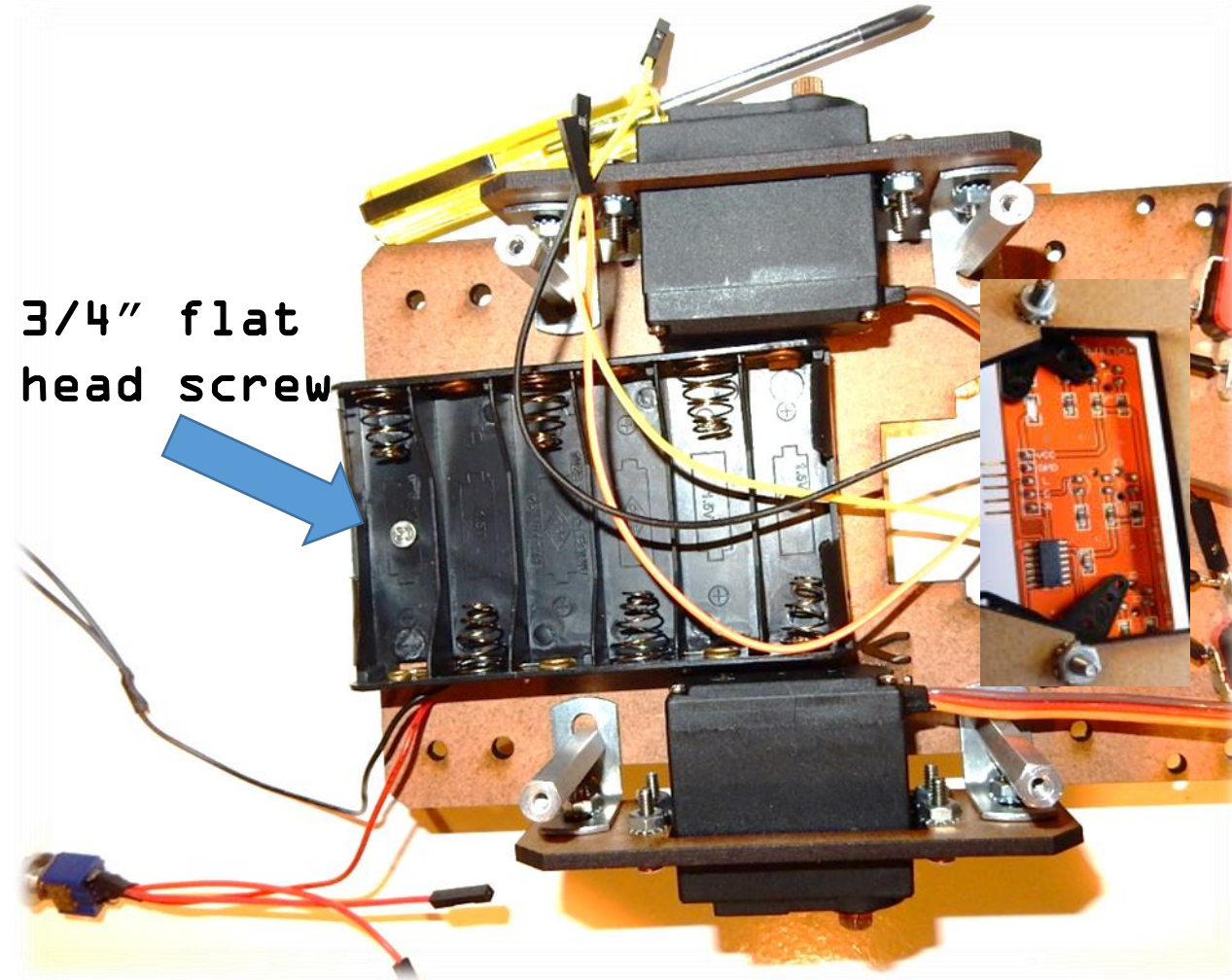
- Battery holder
- (1) 3/4" flat head screw
- (1) acorn nut
- Lower chassis assembly
- (1) lock nut
- Star screwdriver



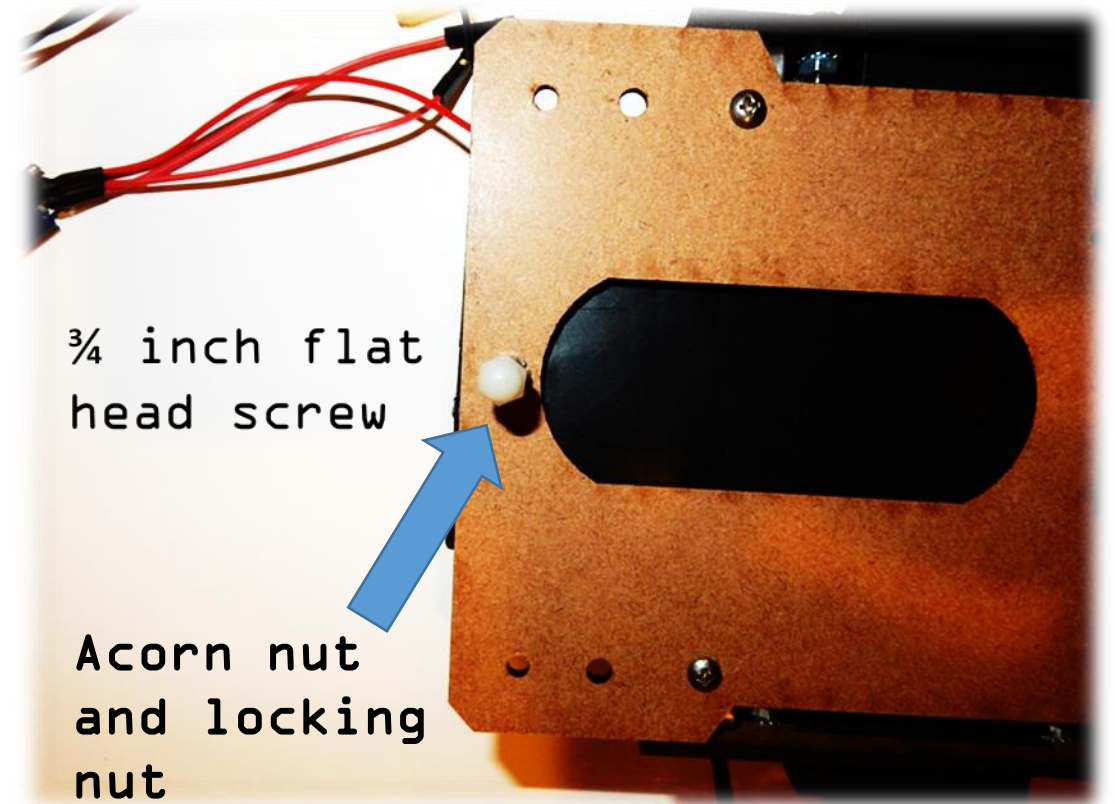
Servo shaft points to front of the chassis

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

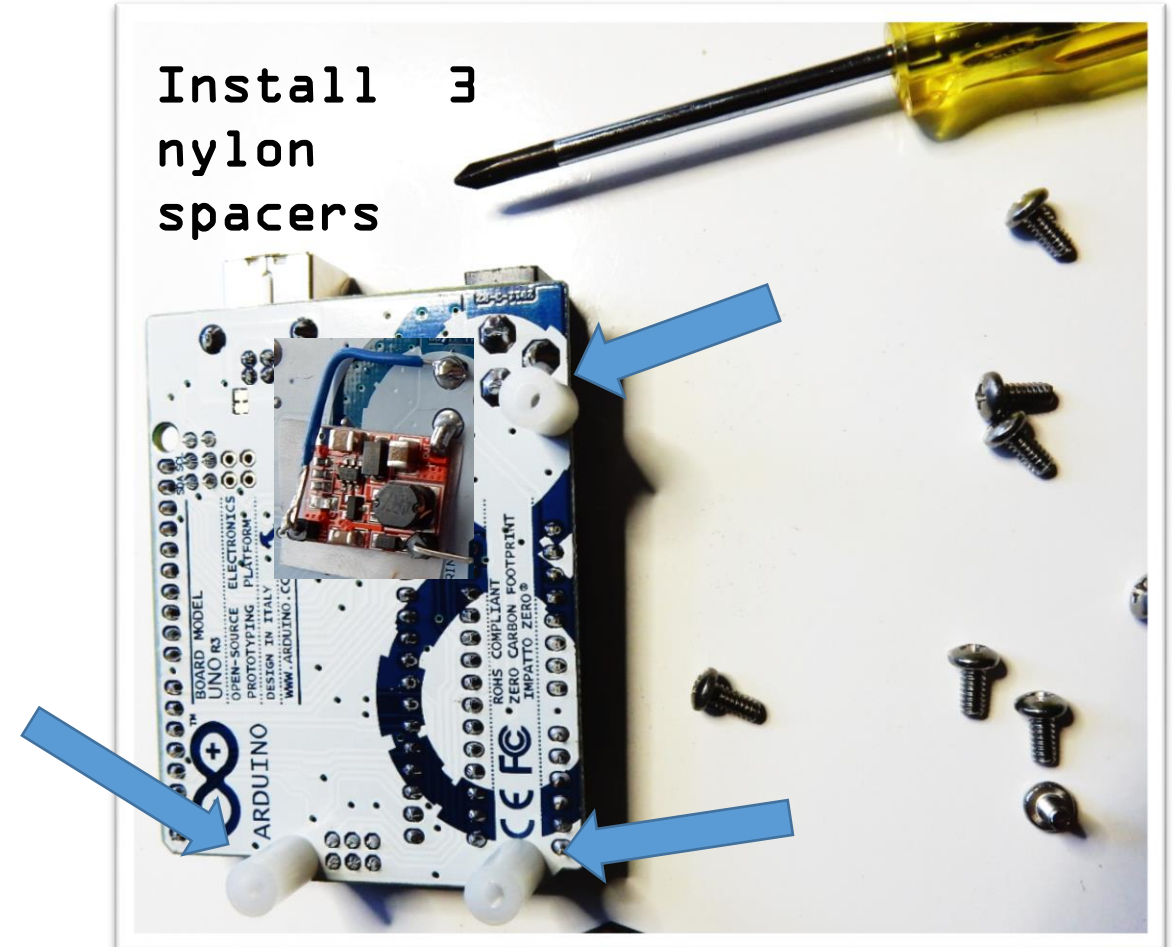
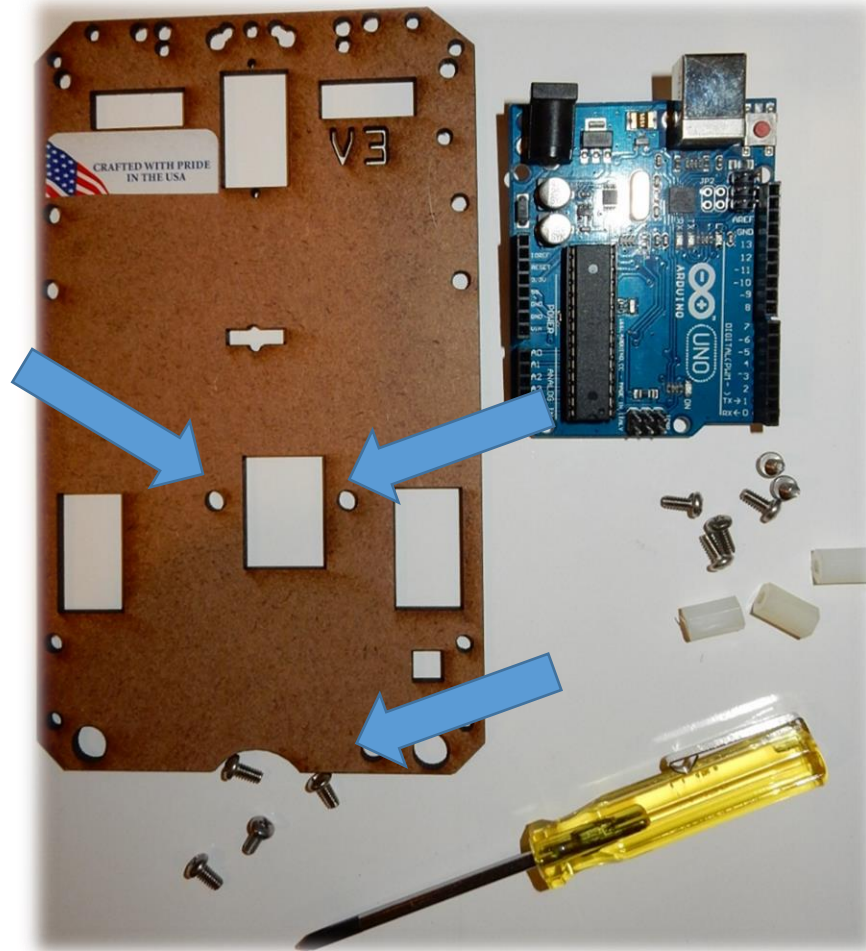


Step 7: Assembling the upper chassis and Arduino board

Parts:

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

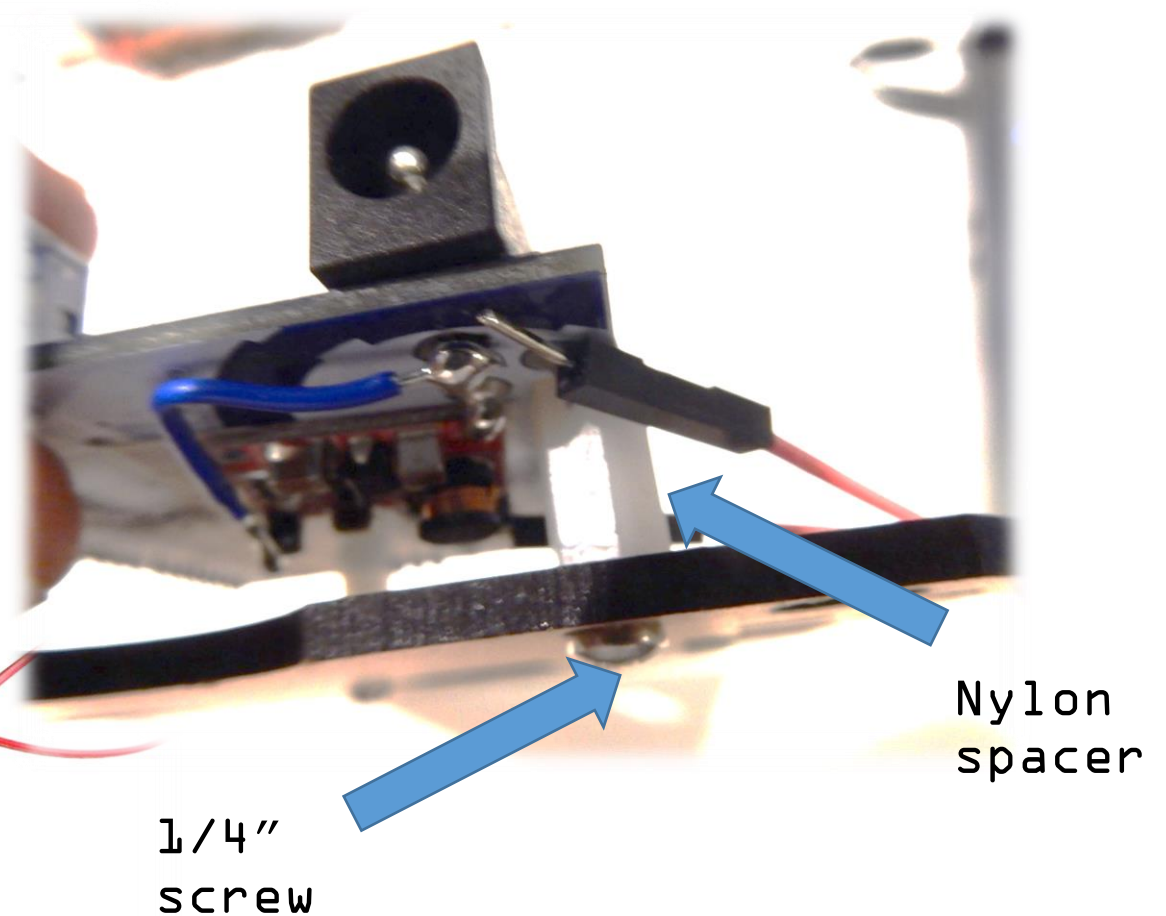
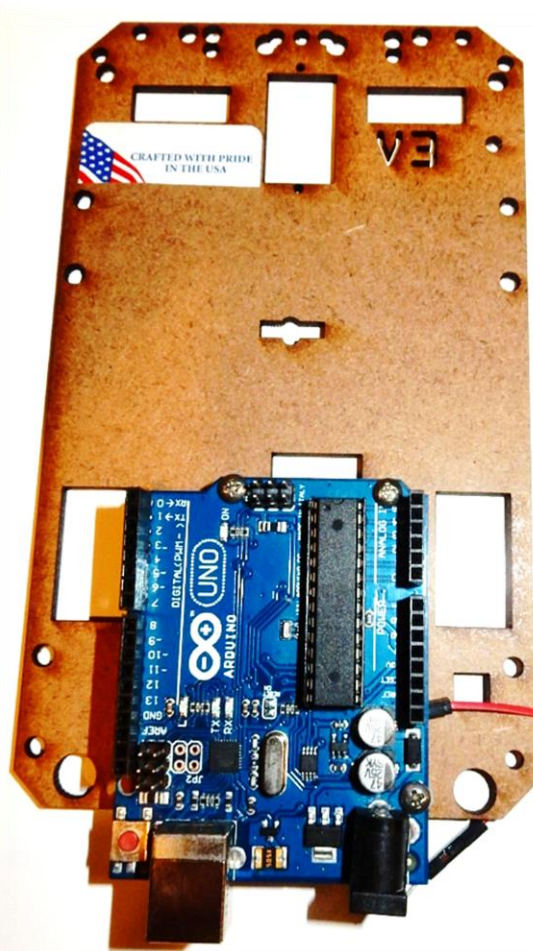
Use the three nylon spacers and three 1/4" screws and install the spacers on the Arduino board as shown below. **Do not tighten yet!**



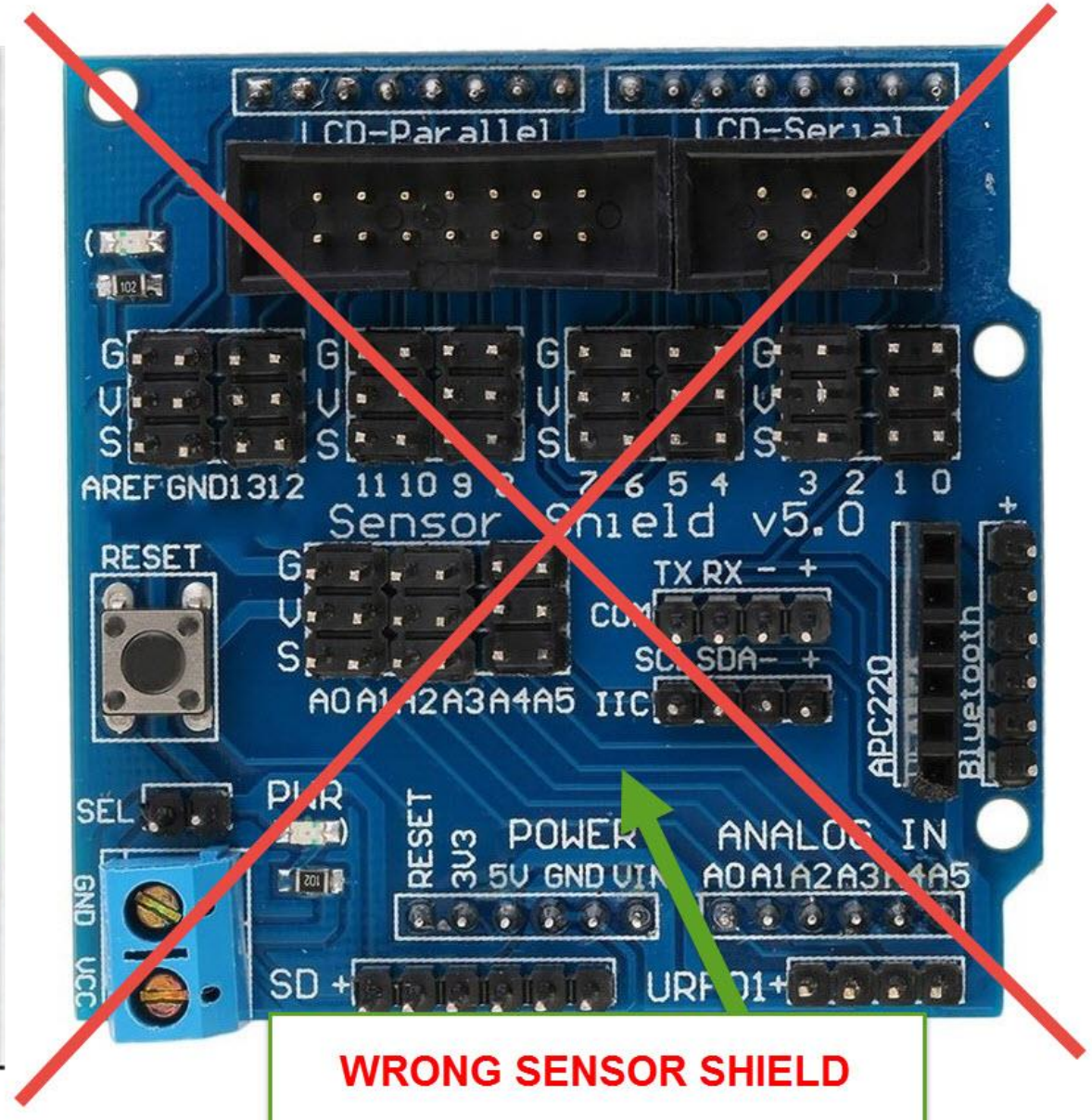
Assembling Arduino board on upper chassis

Note:

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



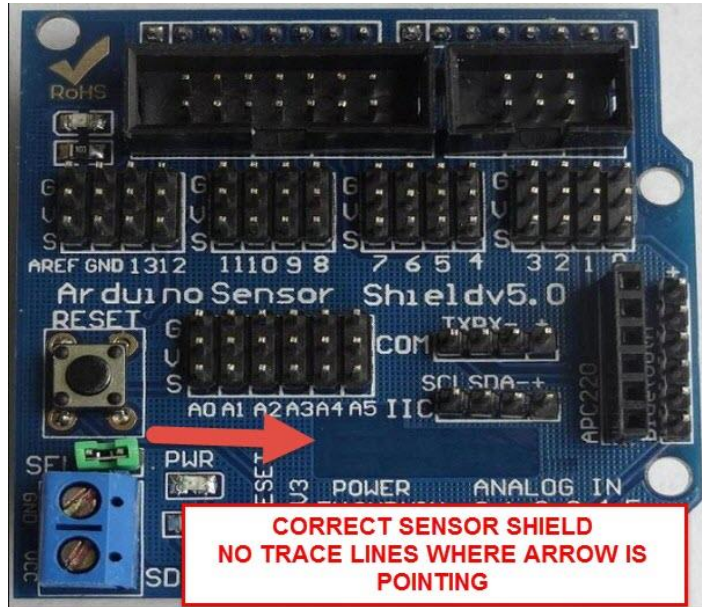
Make sure you have the correct Sensor Shield



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

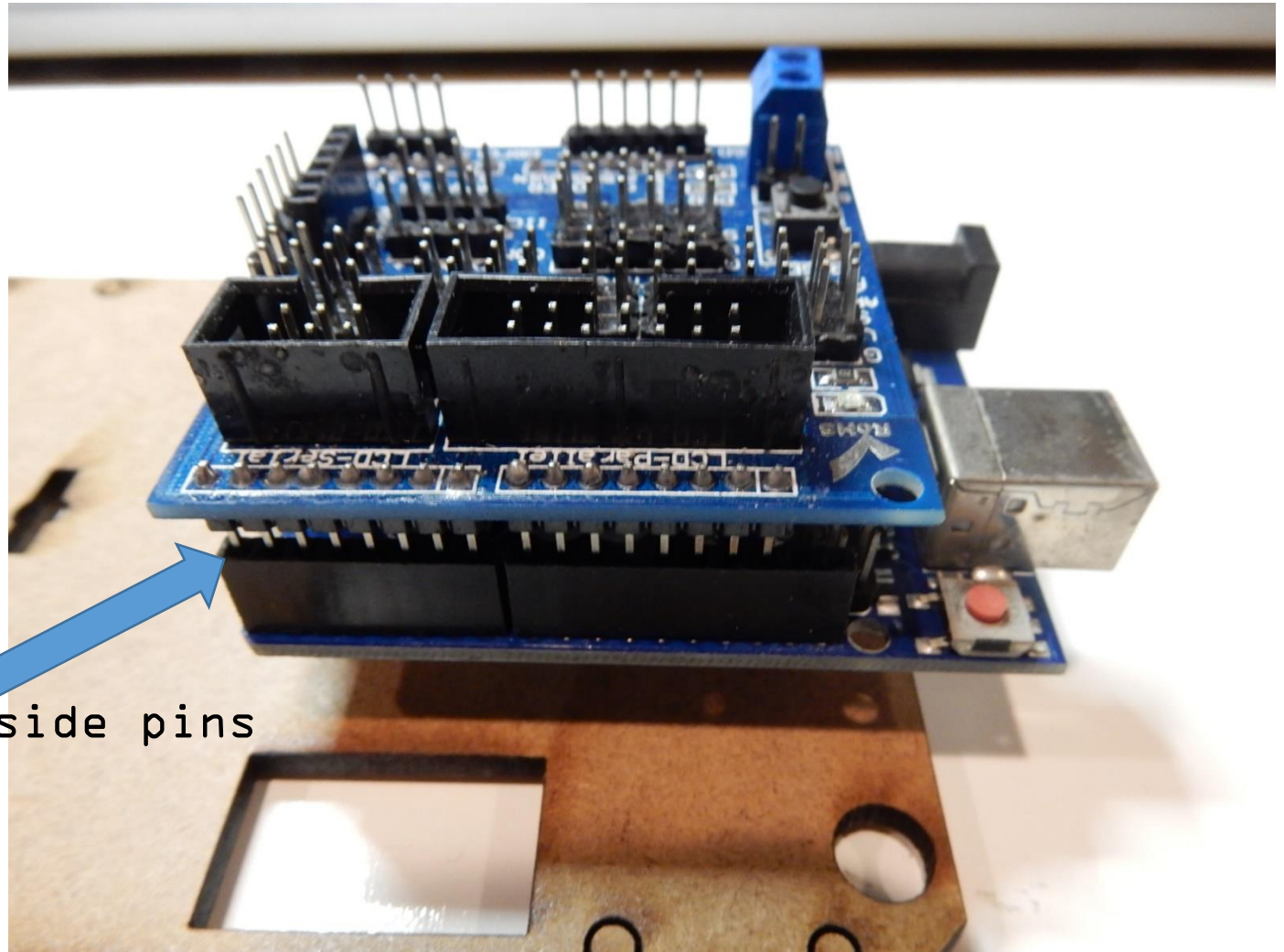
Parts

- Upper chassis
- Sensor Shield 5.0

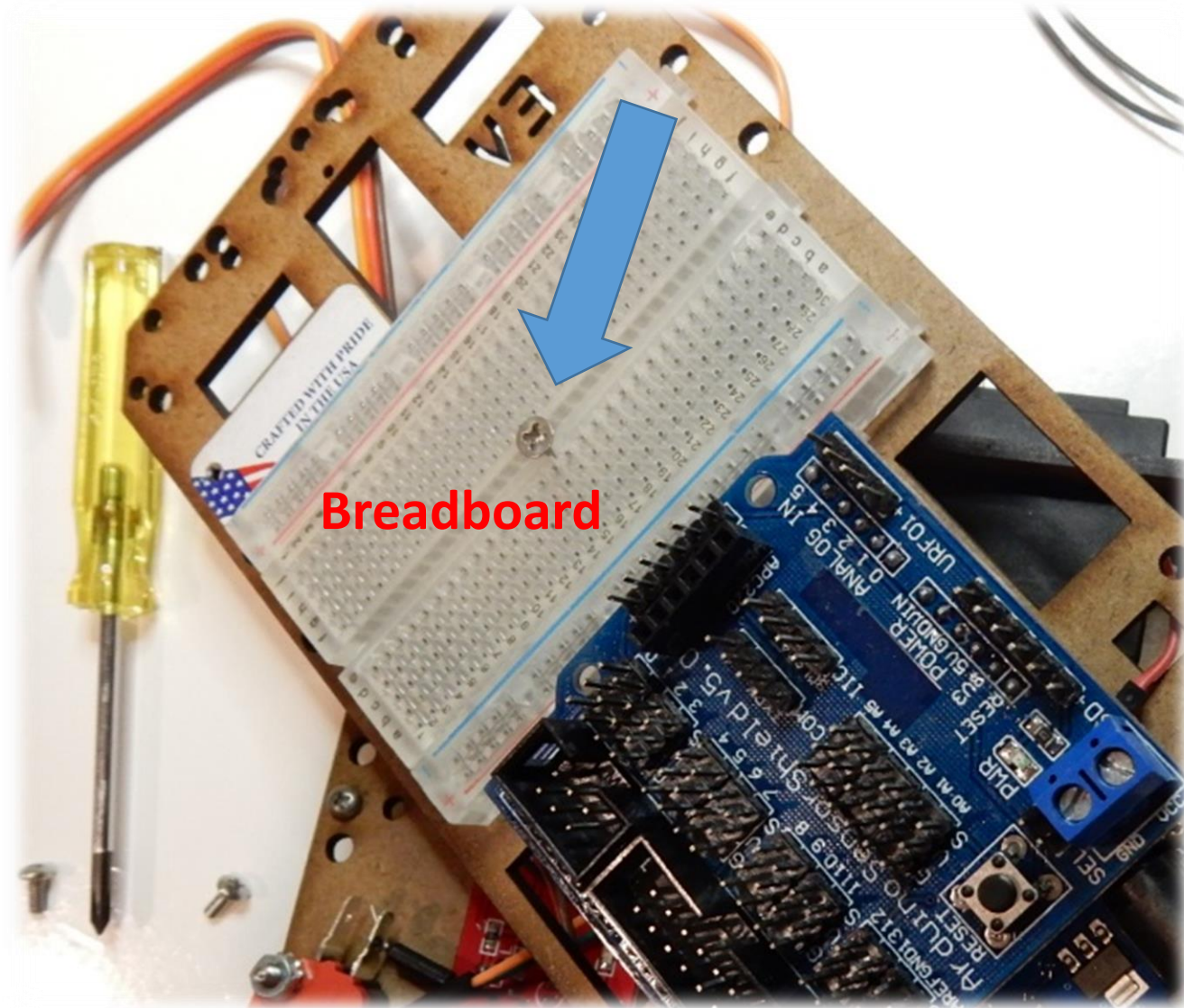


Sensor Shield 5.0
Notice position of pins and direction. Start from the back pins to the front pins. The press all the way down.

Backside pins



Step 8 : Mounting the breadboard or protoboard



Parts

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

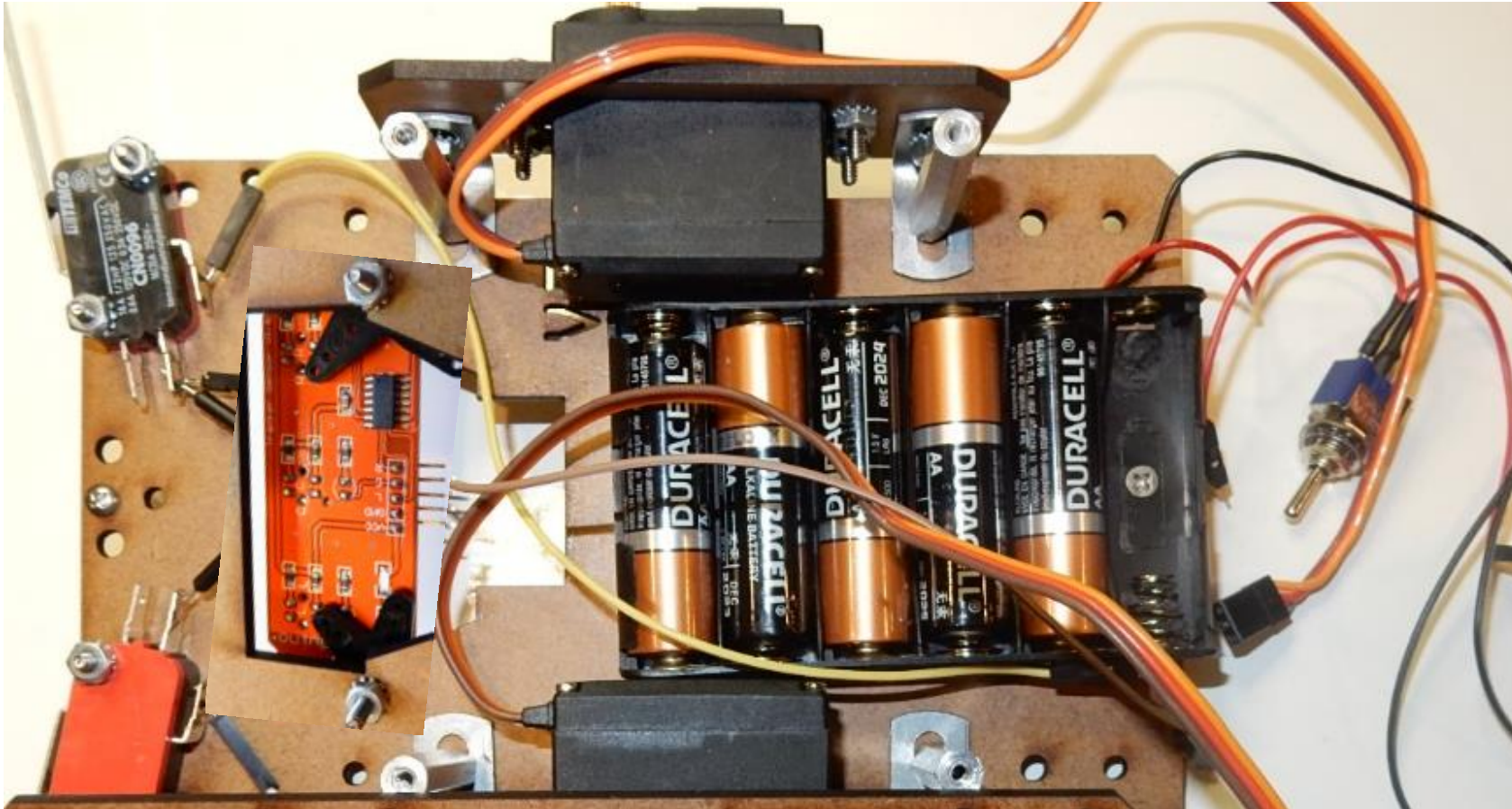
Install the breadboard as shown using the 1" flathead screw (see breadboard packaging for this screw). Align the breadboard in the middle and use locking nut to tighten

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



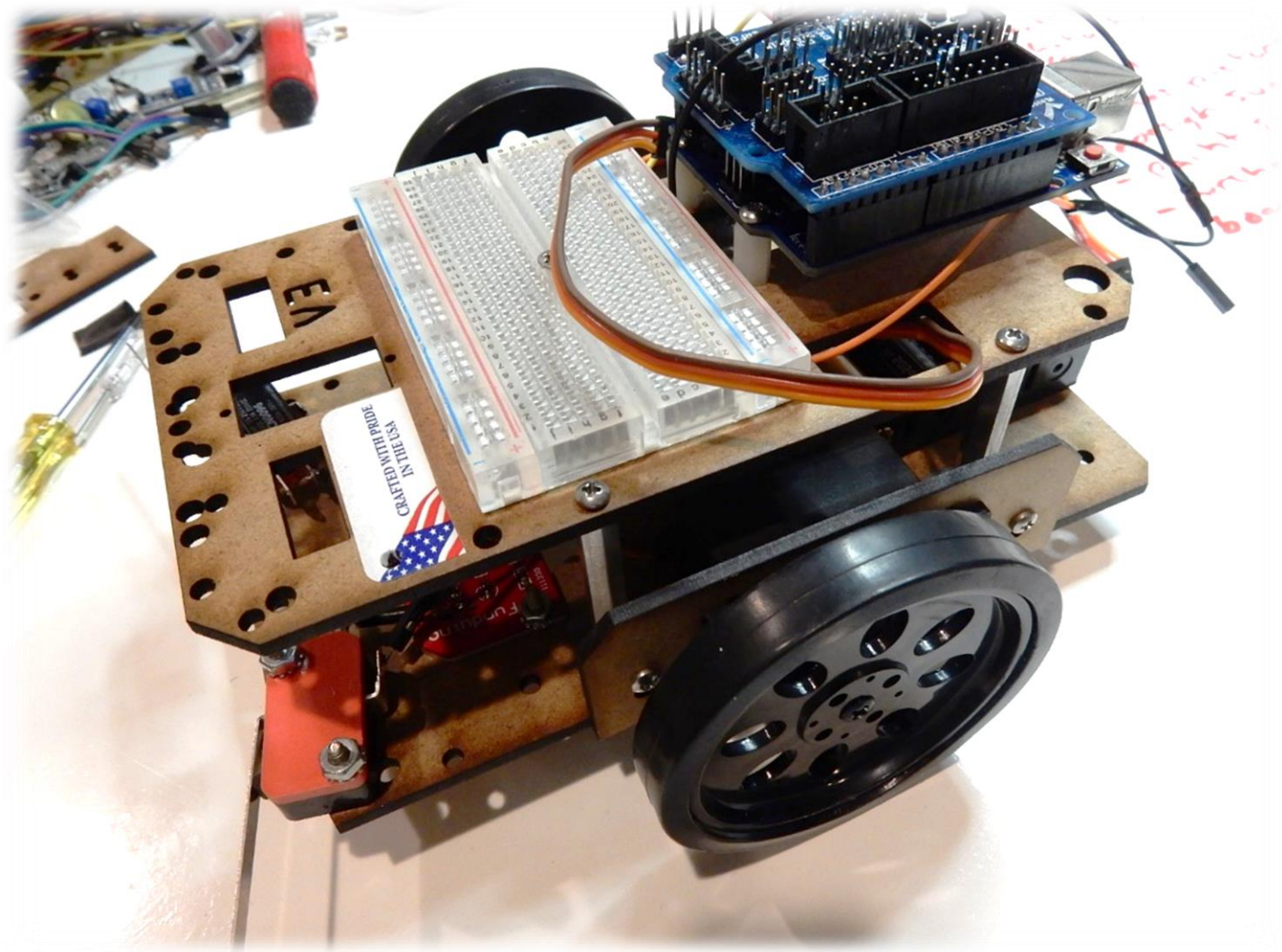
Step 10: Install Upper Chassis on Metal Spacers

Mount the upper chassis to the four metal spacers as show below using the $\frac{1}{4}$ 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

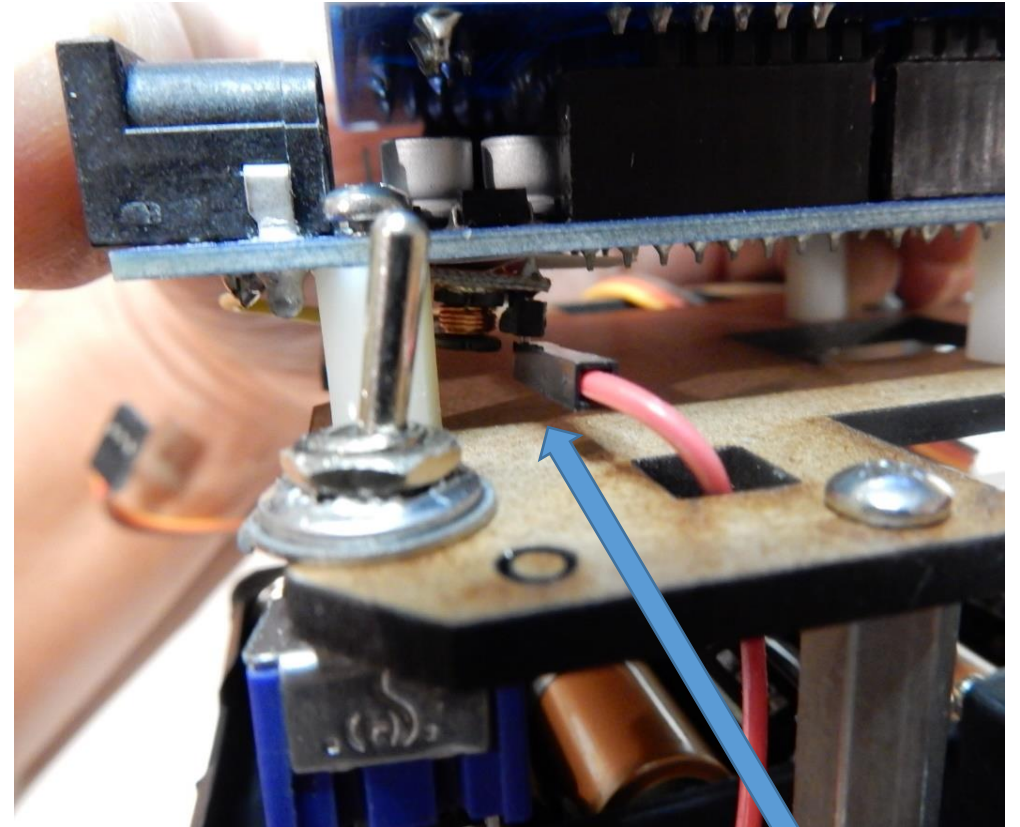
Parts

- Upper chassis
- (4) $\frac{1}{4}$ " 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

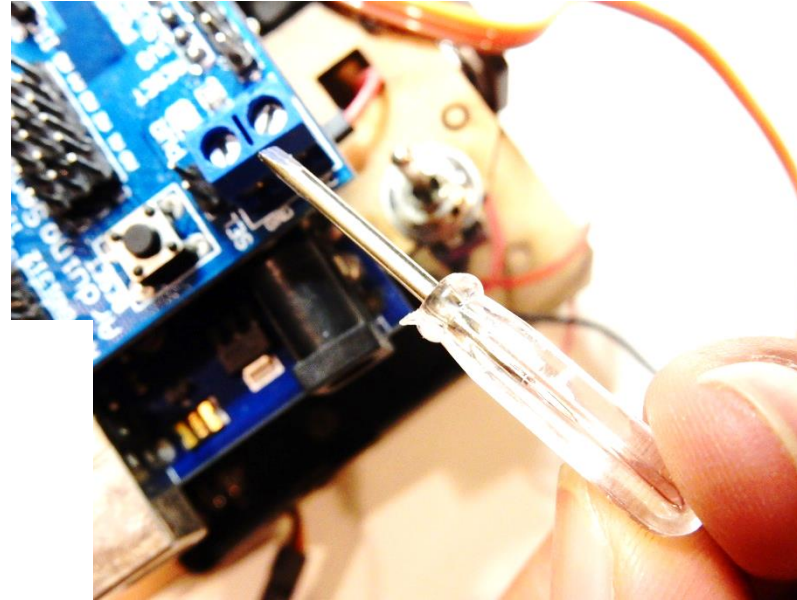
Parts

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

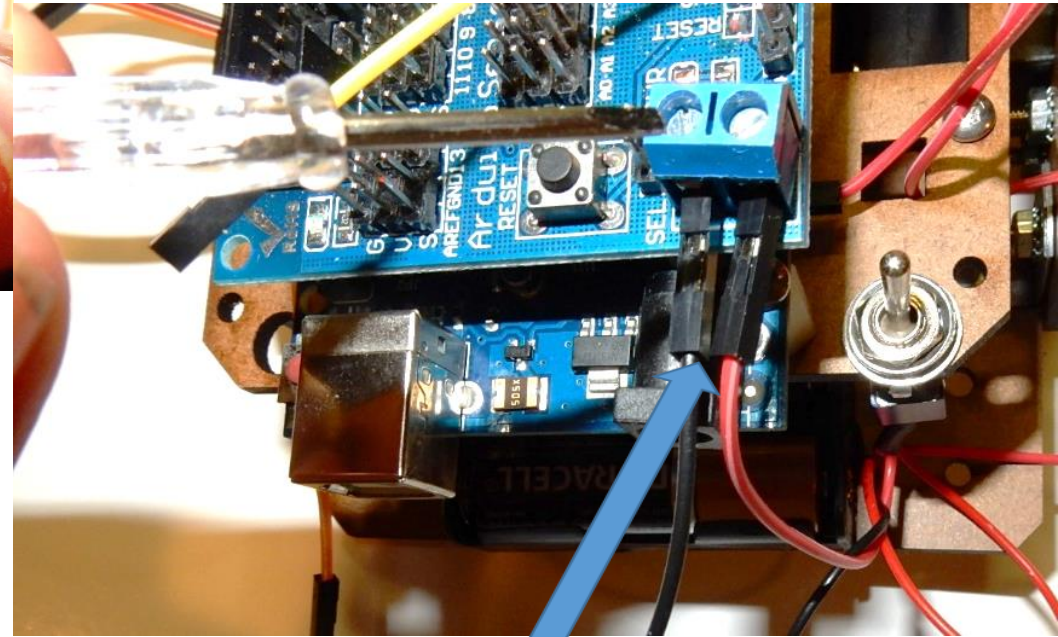
Using the small flat screwdriver loosen the screw terminal connectors and insert wires then screw back in to secure. If robot turns ON just turn the switch to the OFF position



DC-DC Step Down Converter



Sensor shield
screw terminals



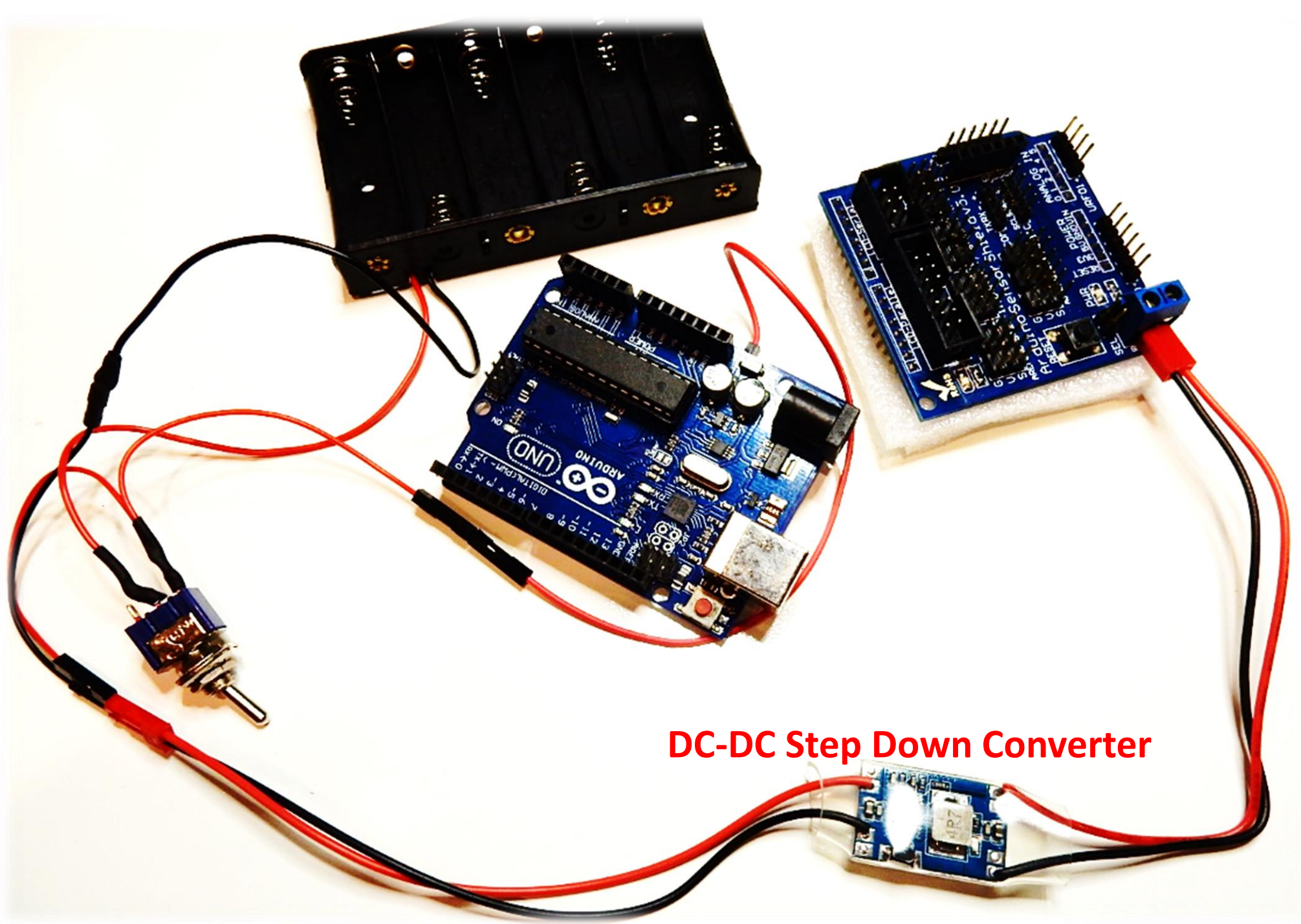
Connect black Dupont male wire from battery pack on the side labeled GND and the red Dupont male wire from the battery on the right side labeled VCC.

You can install the last battery³⁵ 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 stabilize 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.



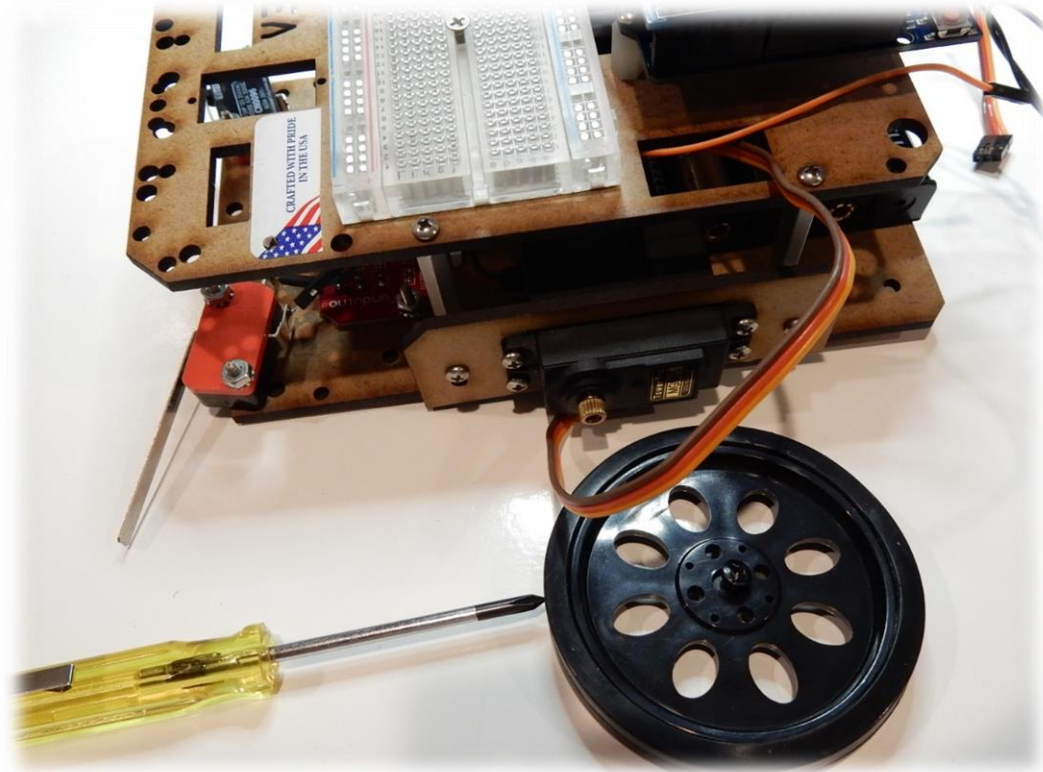
DC-DC Step Down Converter

Step 12: Assembling the wheels

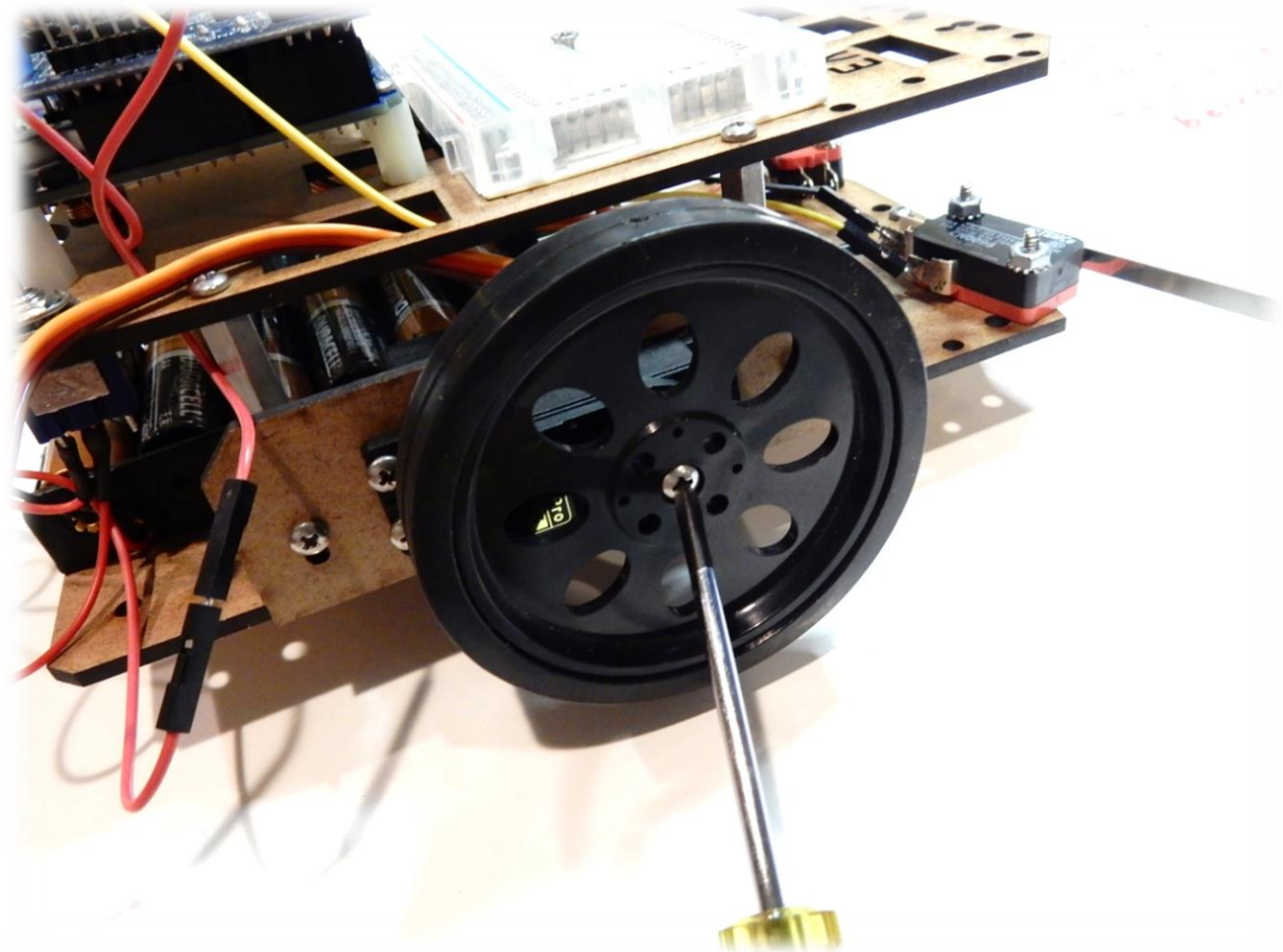
Parts

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

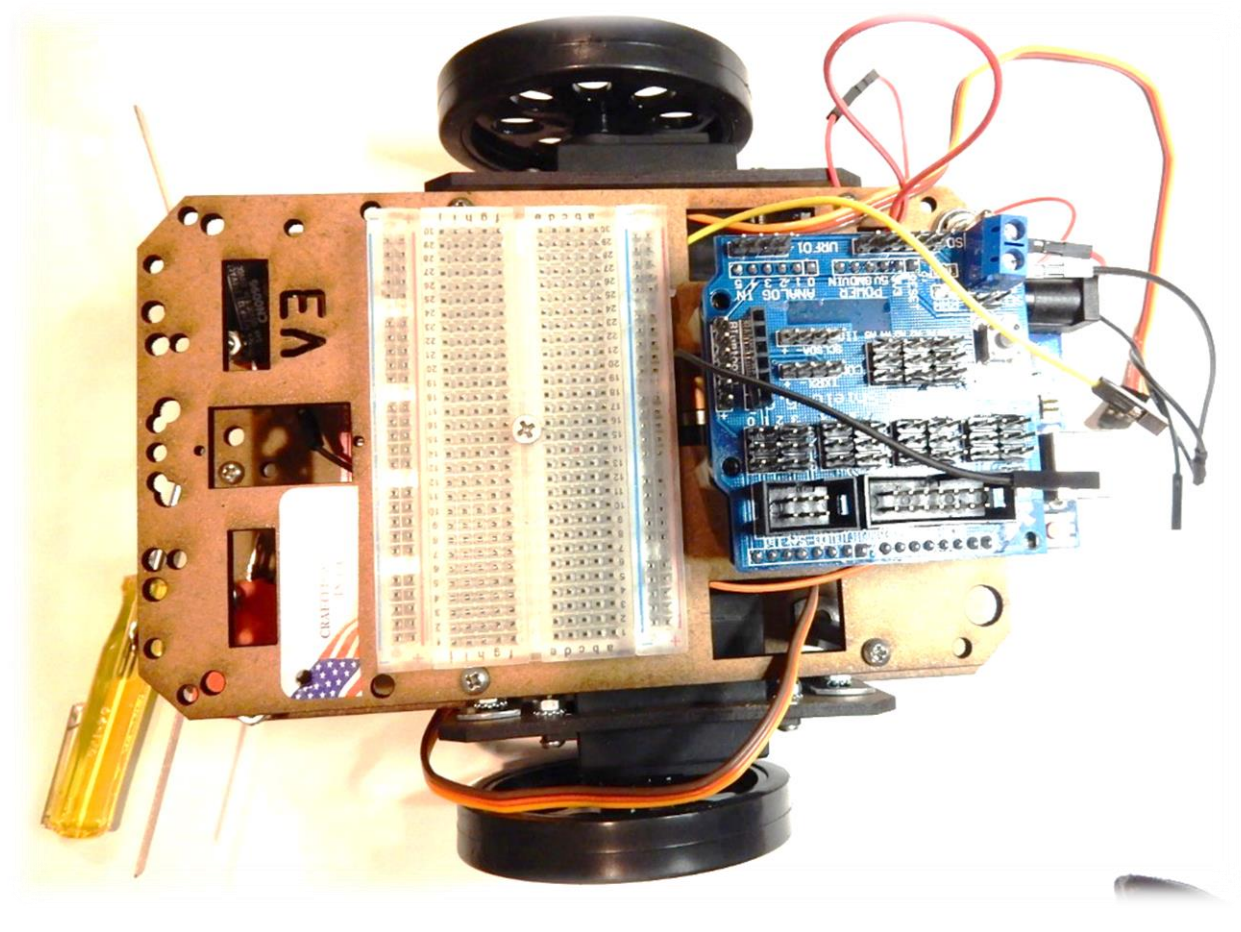
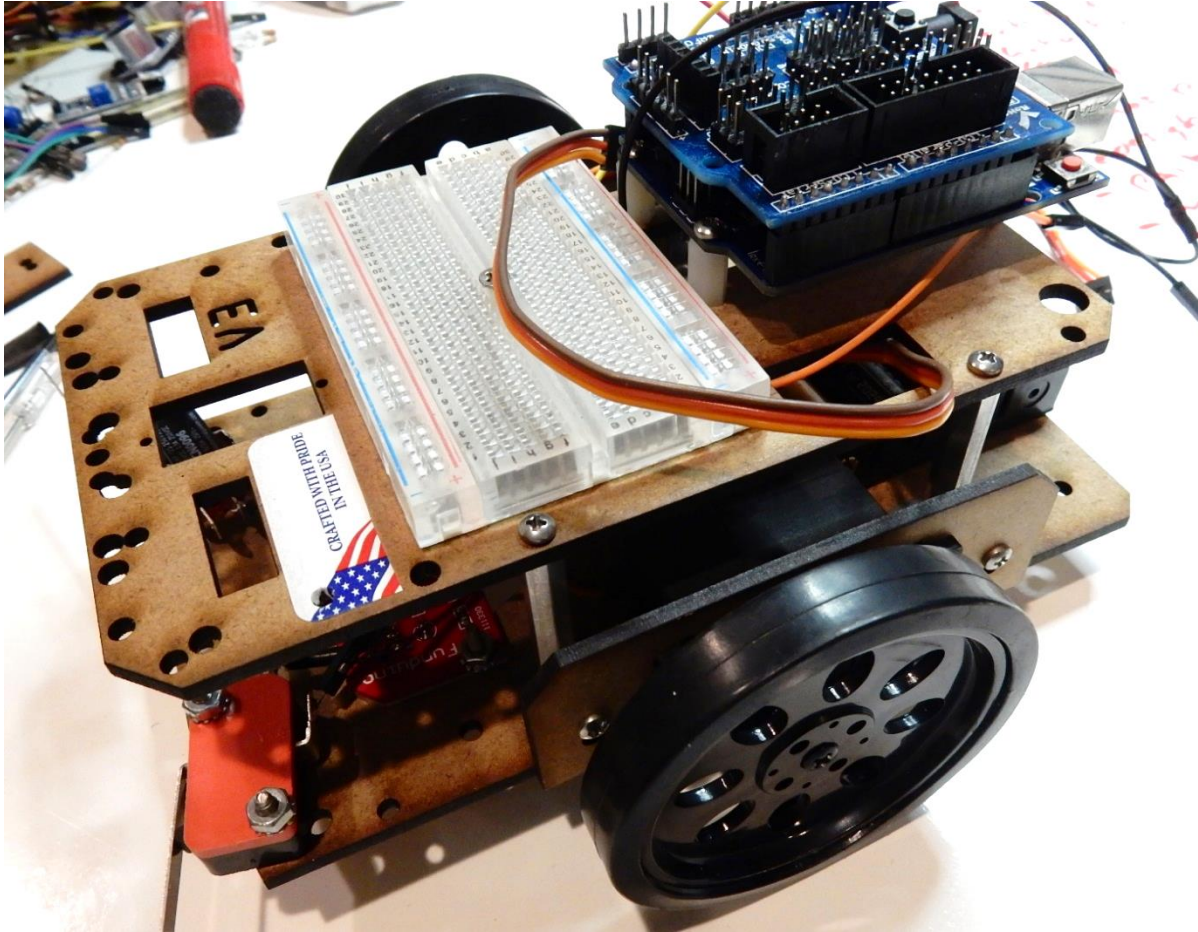
Insert wheel carefully, but with force to the shaft of the servo motor. Use only the screws that come in the bag of servo horns. These will make sure to hold the wheels.



Wheel screws comes in the servo bags of spare horns



completed chassis and wheels assembly



Step 13: Mounting the Adjustable Infrared Sensors

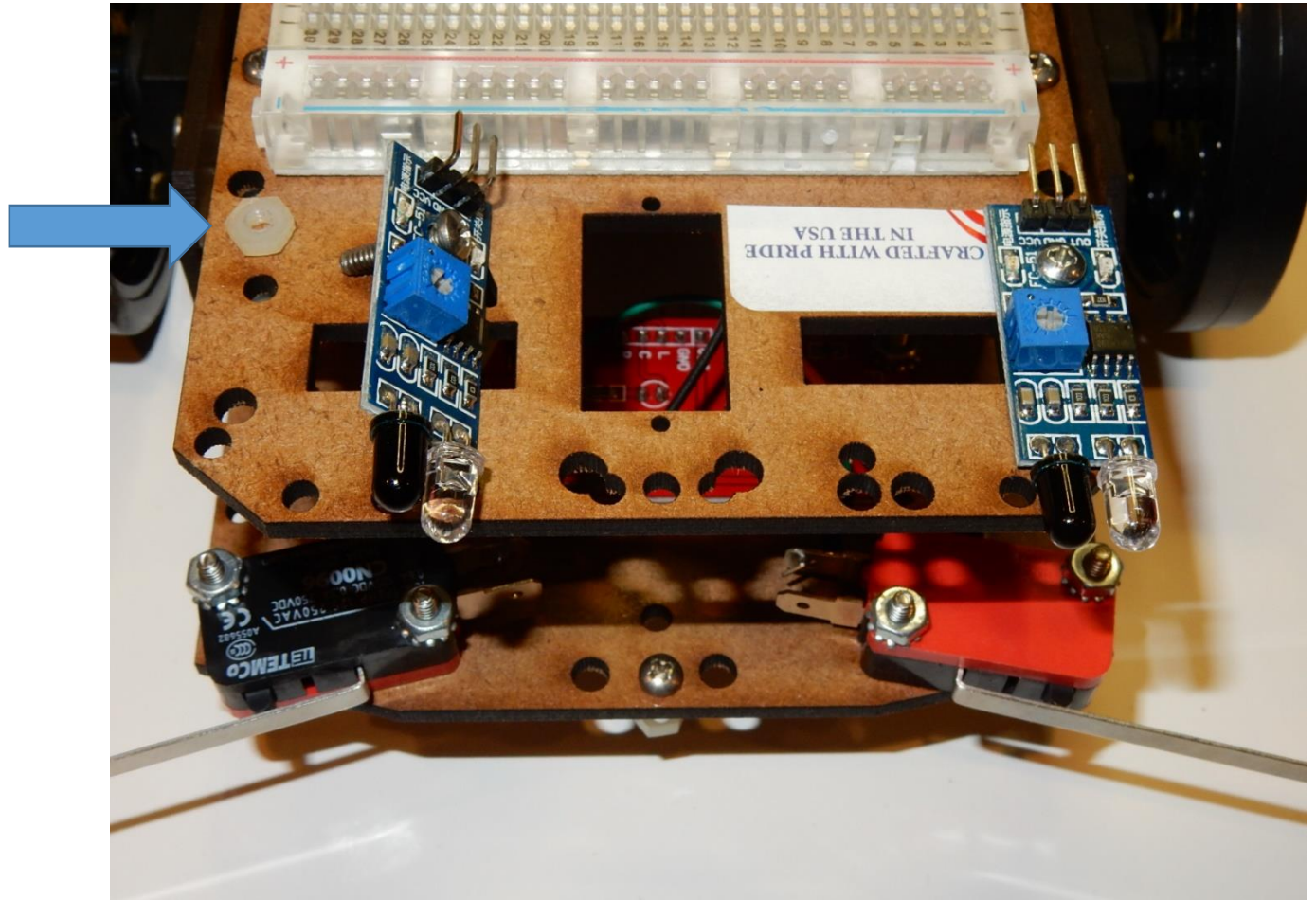
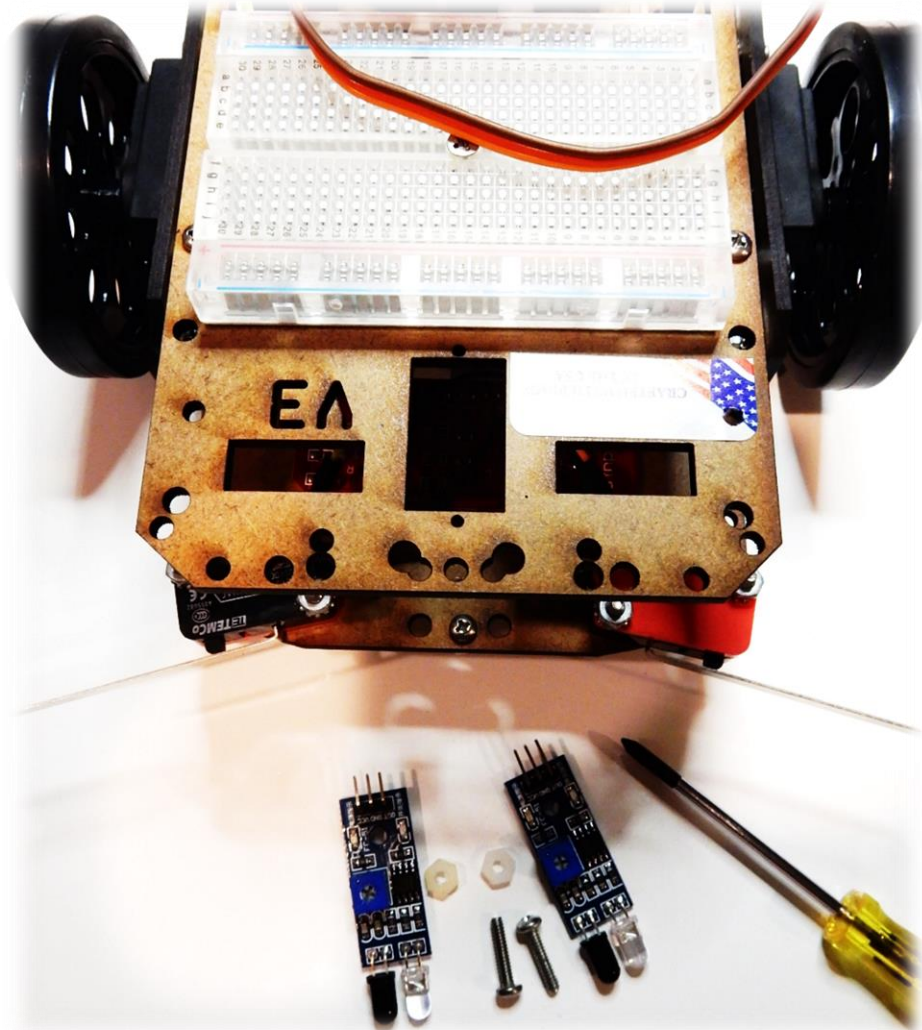
Parts

(2) Adjustable IR sensors

(2) 1/2" pan head screws

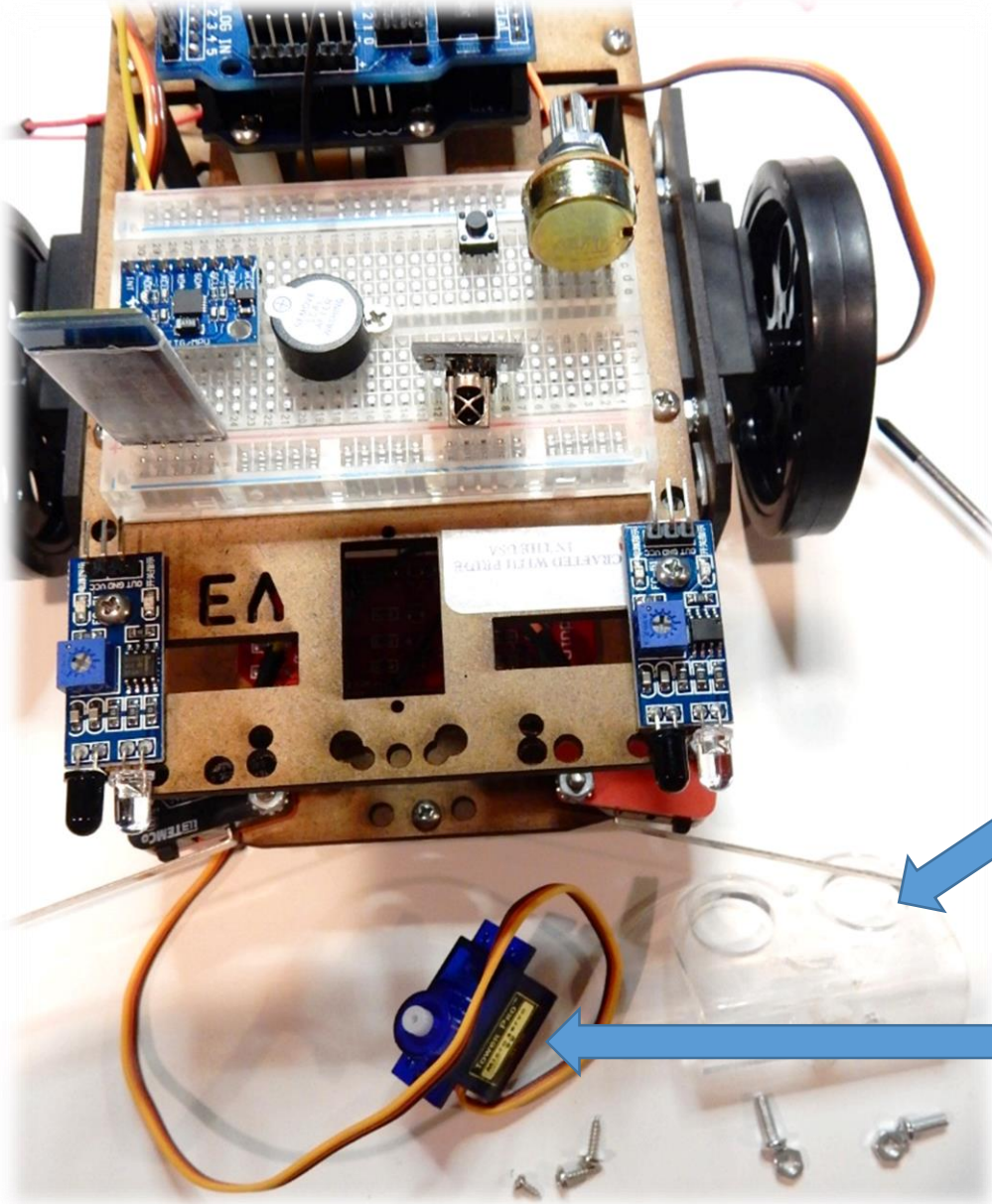
(2) Nylon nuts

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

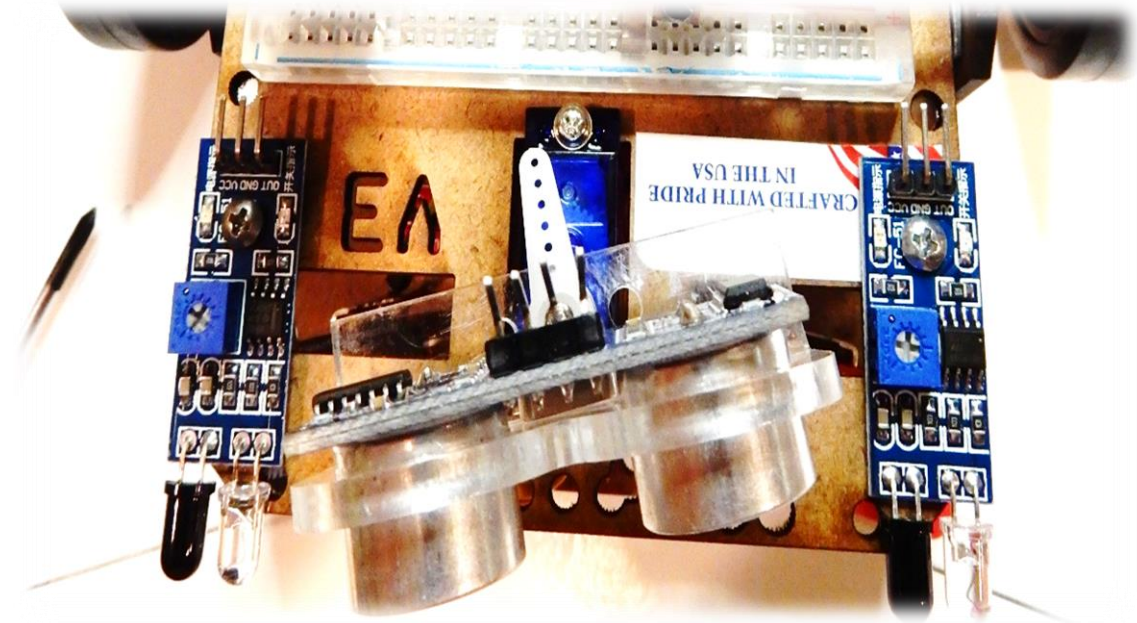
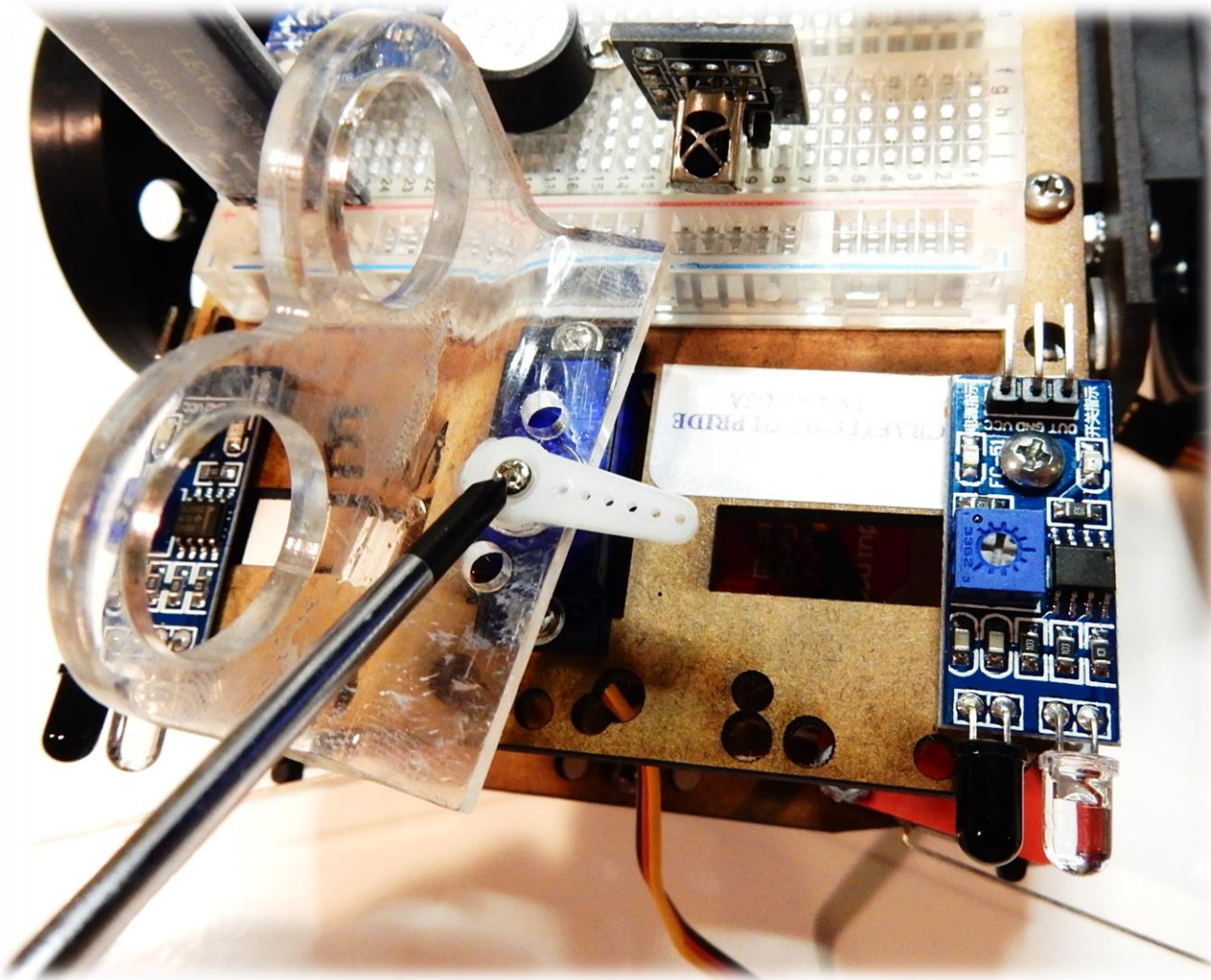


← Sonar sensor

Clear sonar sensor holder

Micro Servo and mounting screws

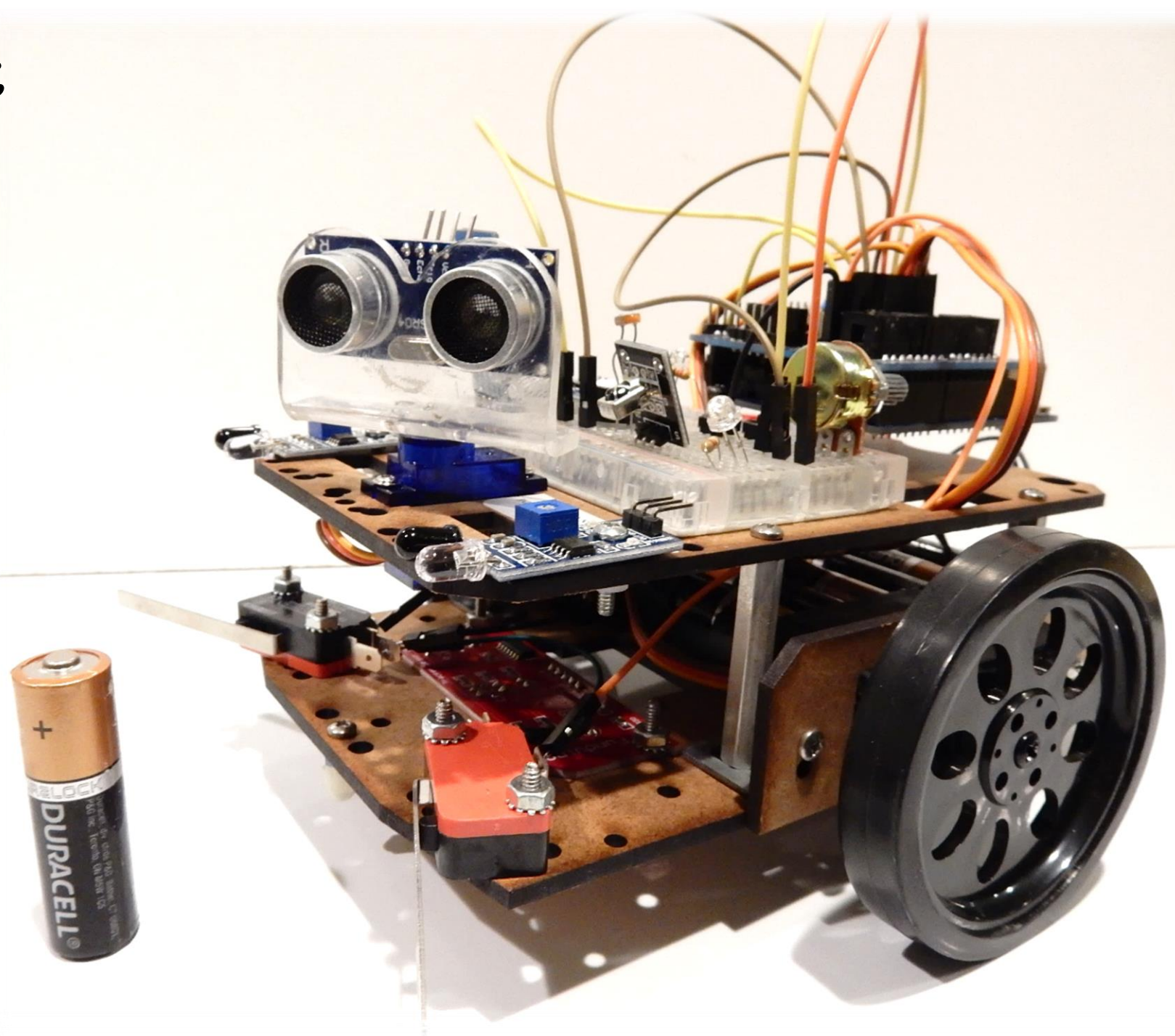
Mount micro servo on top chassis. Make sure motor shaft is facing the front of robot. Carefully screw the servo using the two small screws that came with it. The smallest screw of the three is to secure the sonar sensor clear bracket.



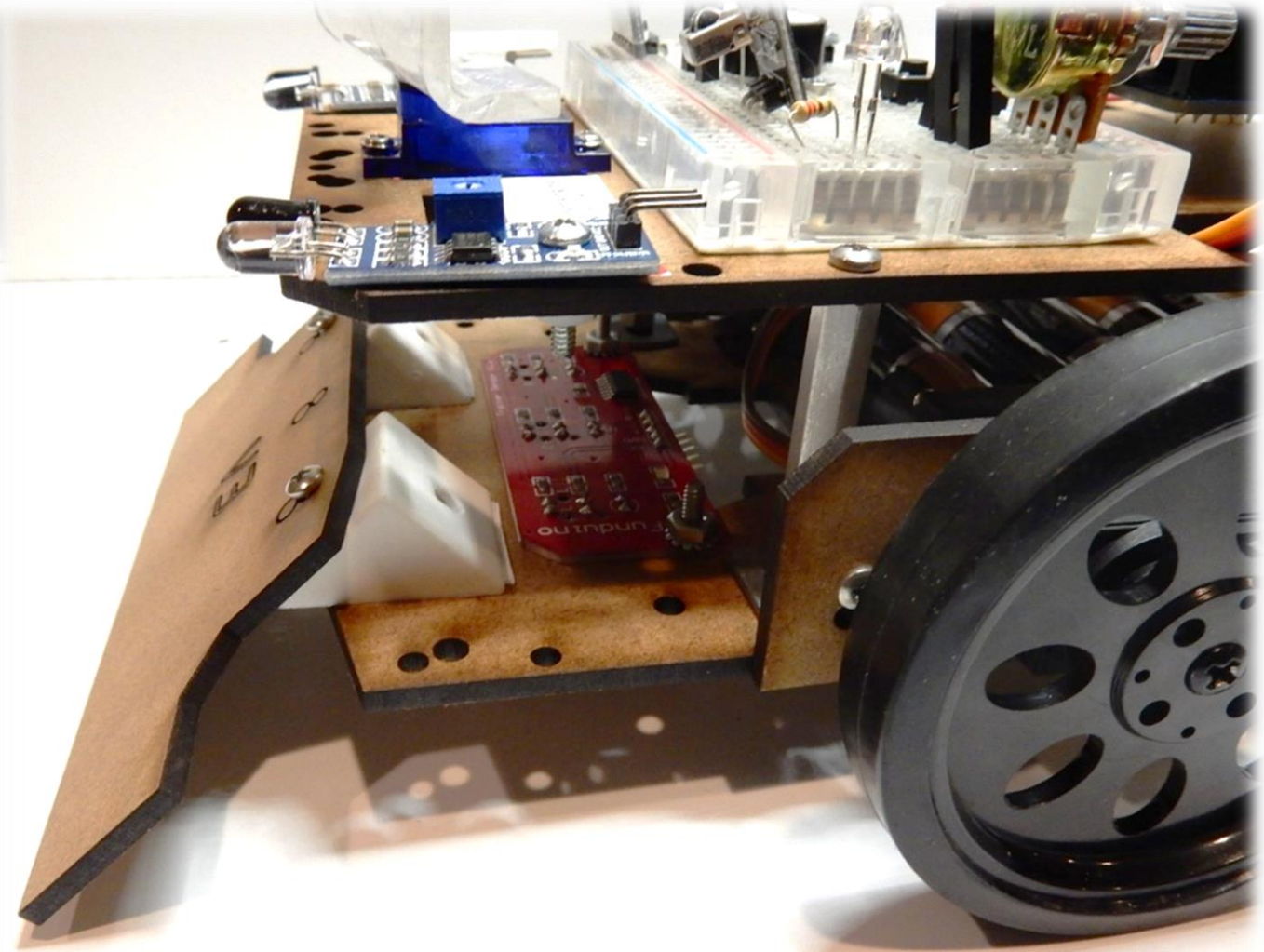
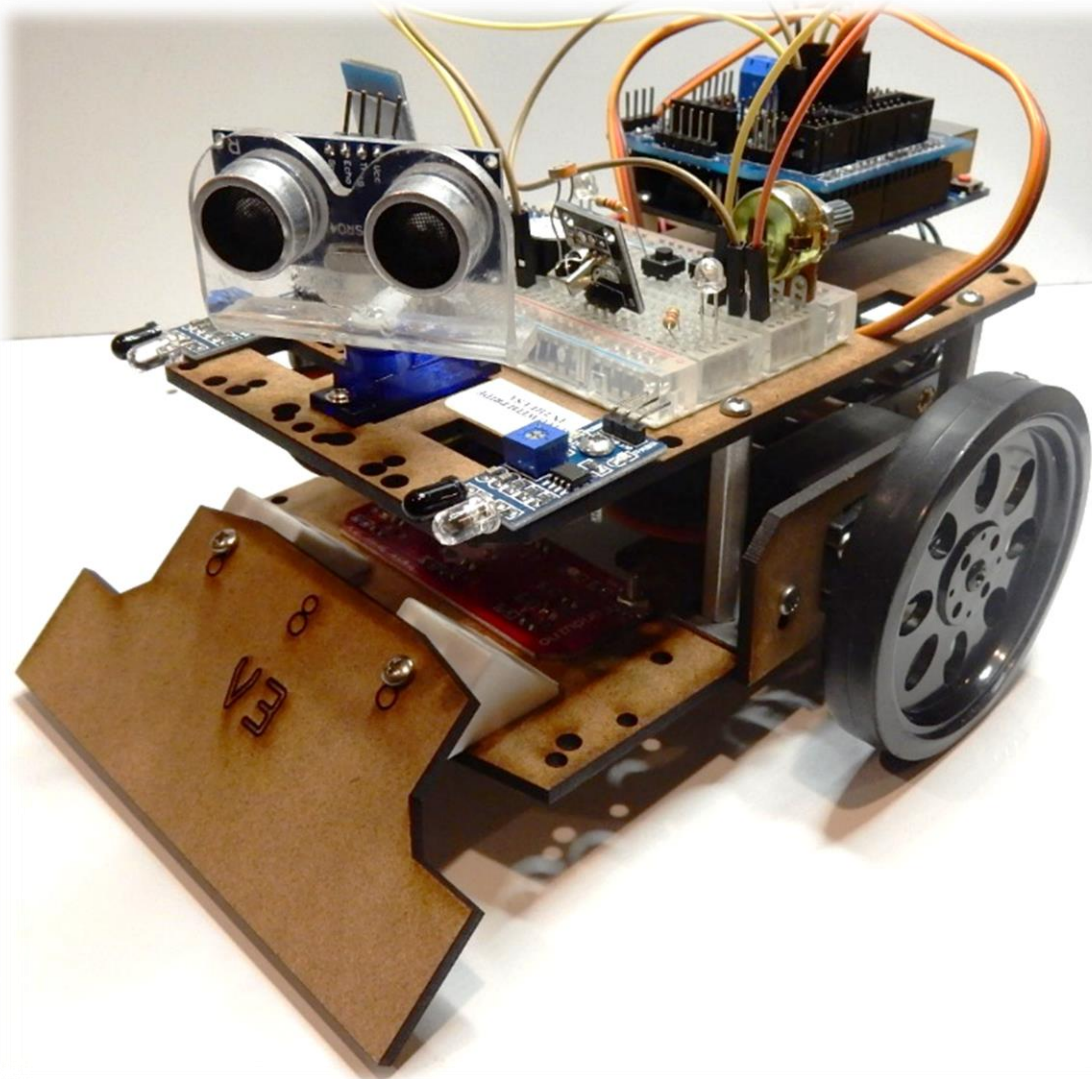
Completed robot
with sample
components on
the breadboard!

We are ready to try
Experiment 1

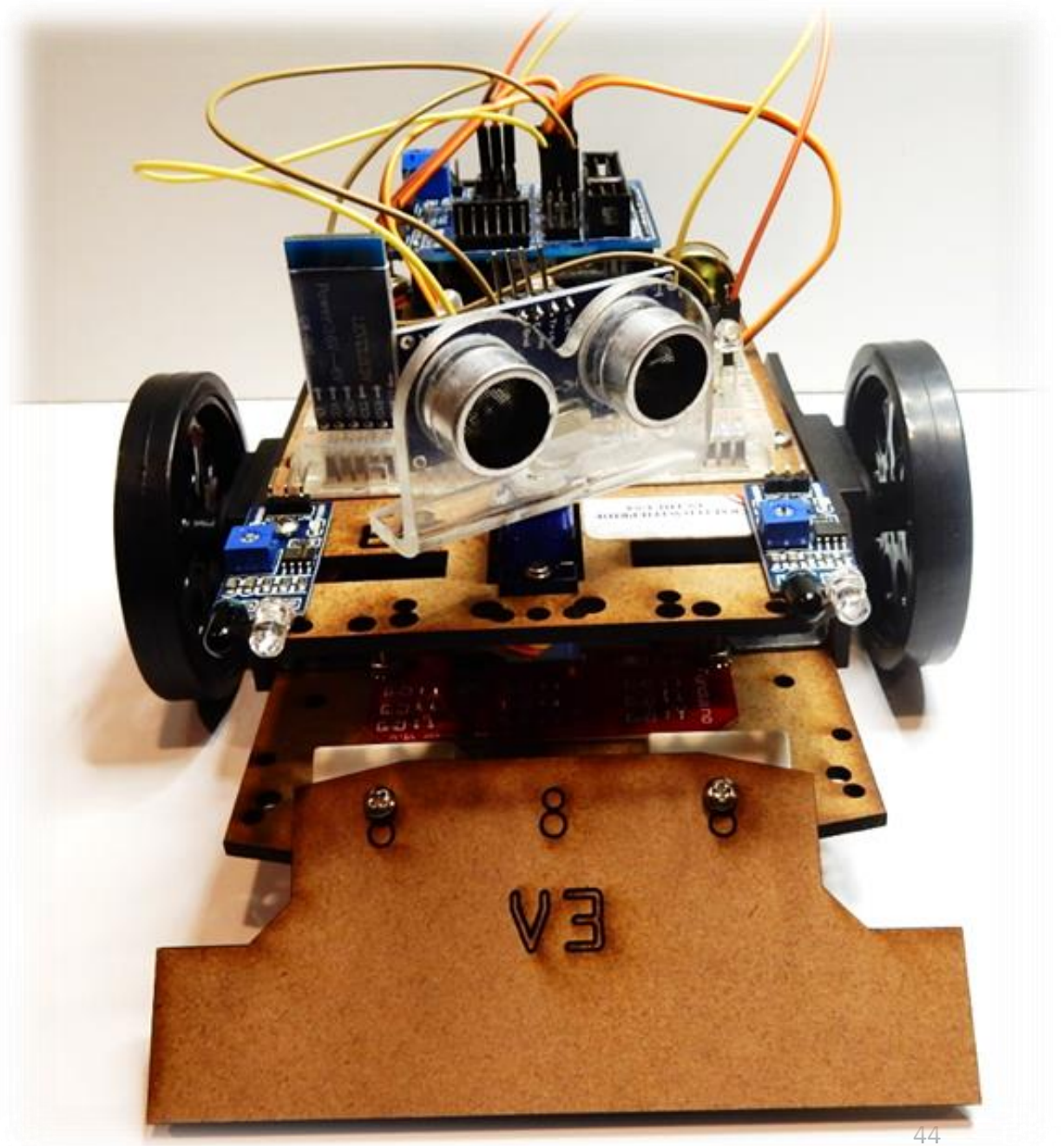
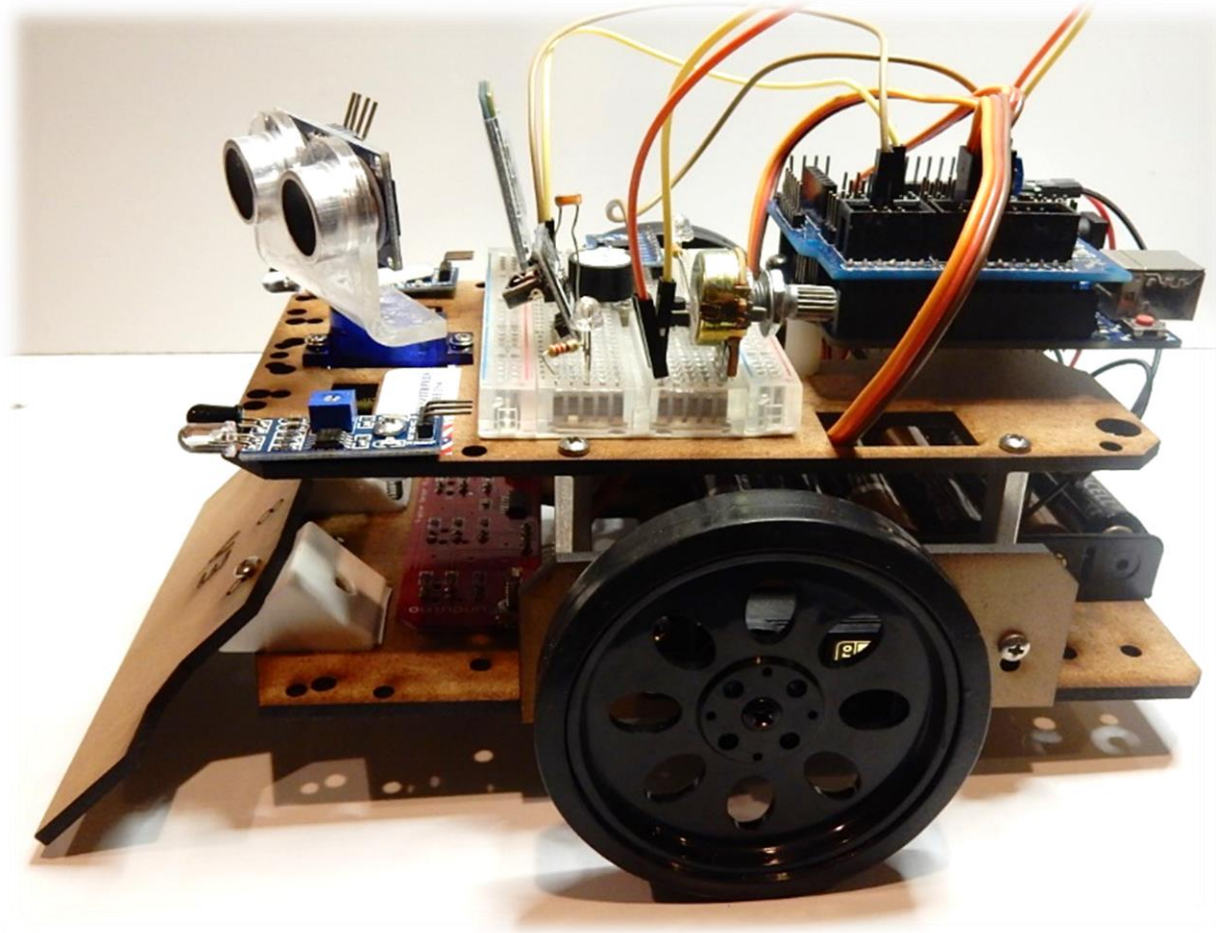
Go to the website
to download
Experiment 1



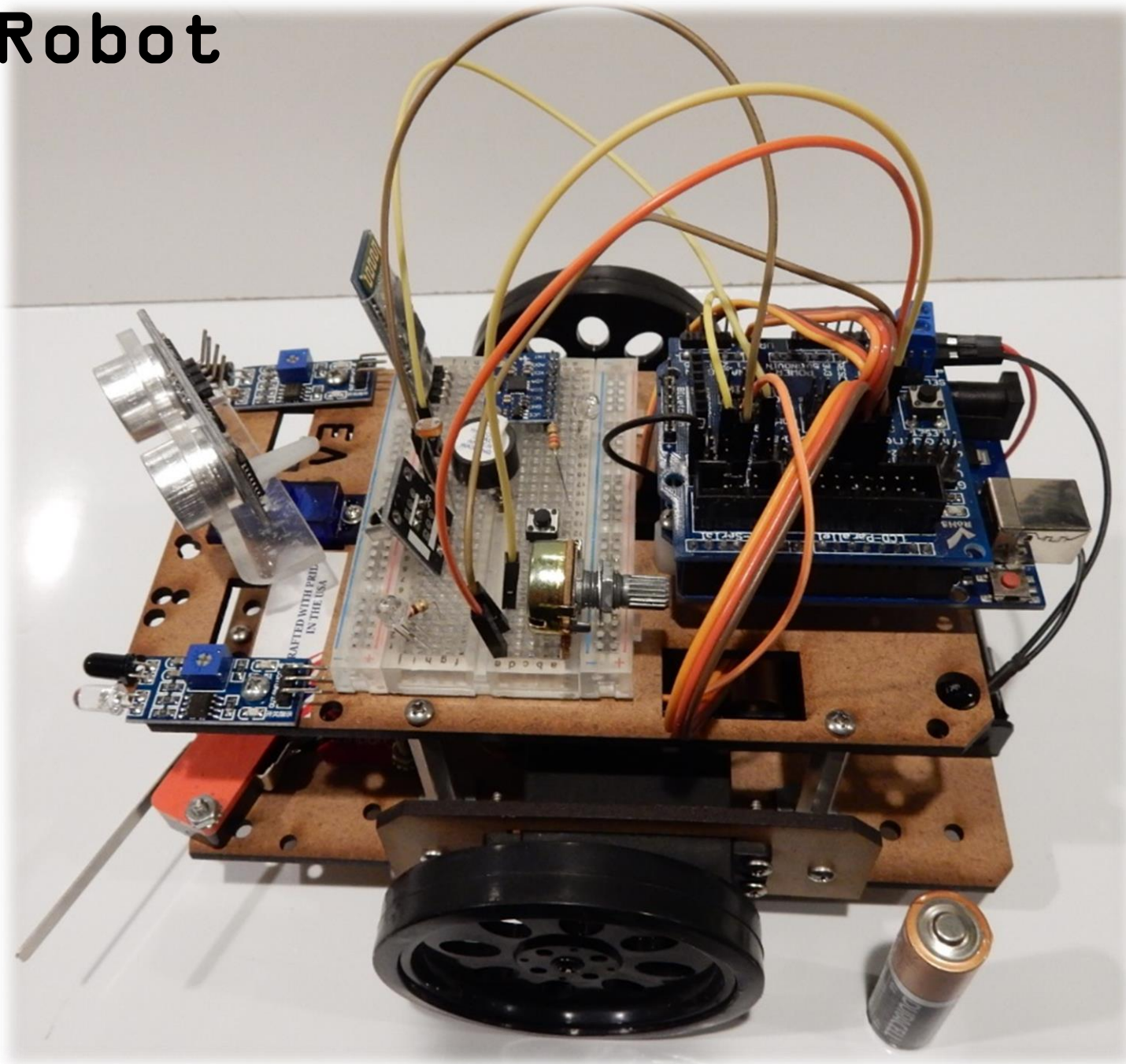
Sumo Robot – See Experiment 6 Sumo Robot for assembly instructions when ready



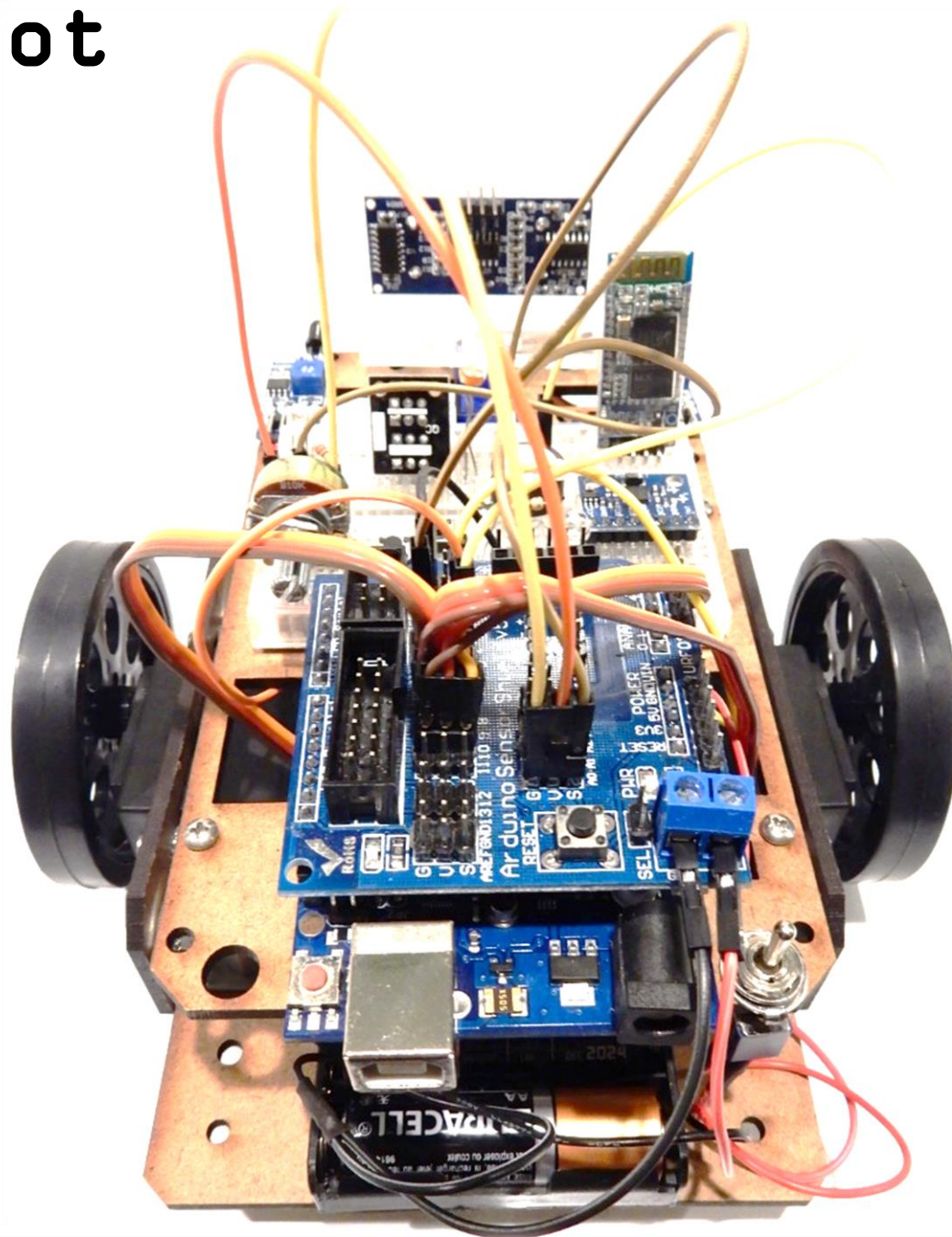
Sumo Robot



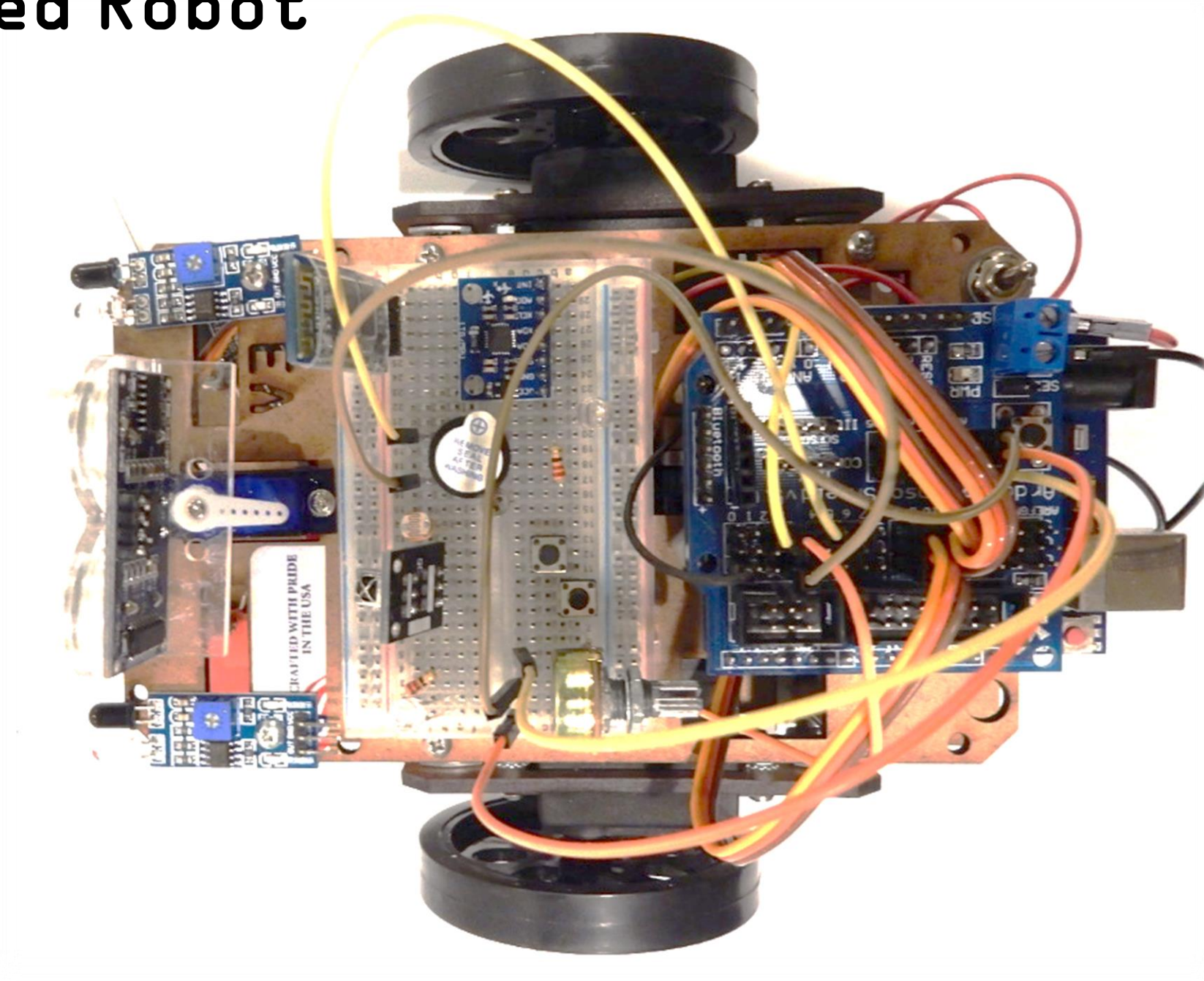
Completed Robot



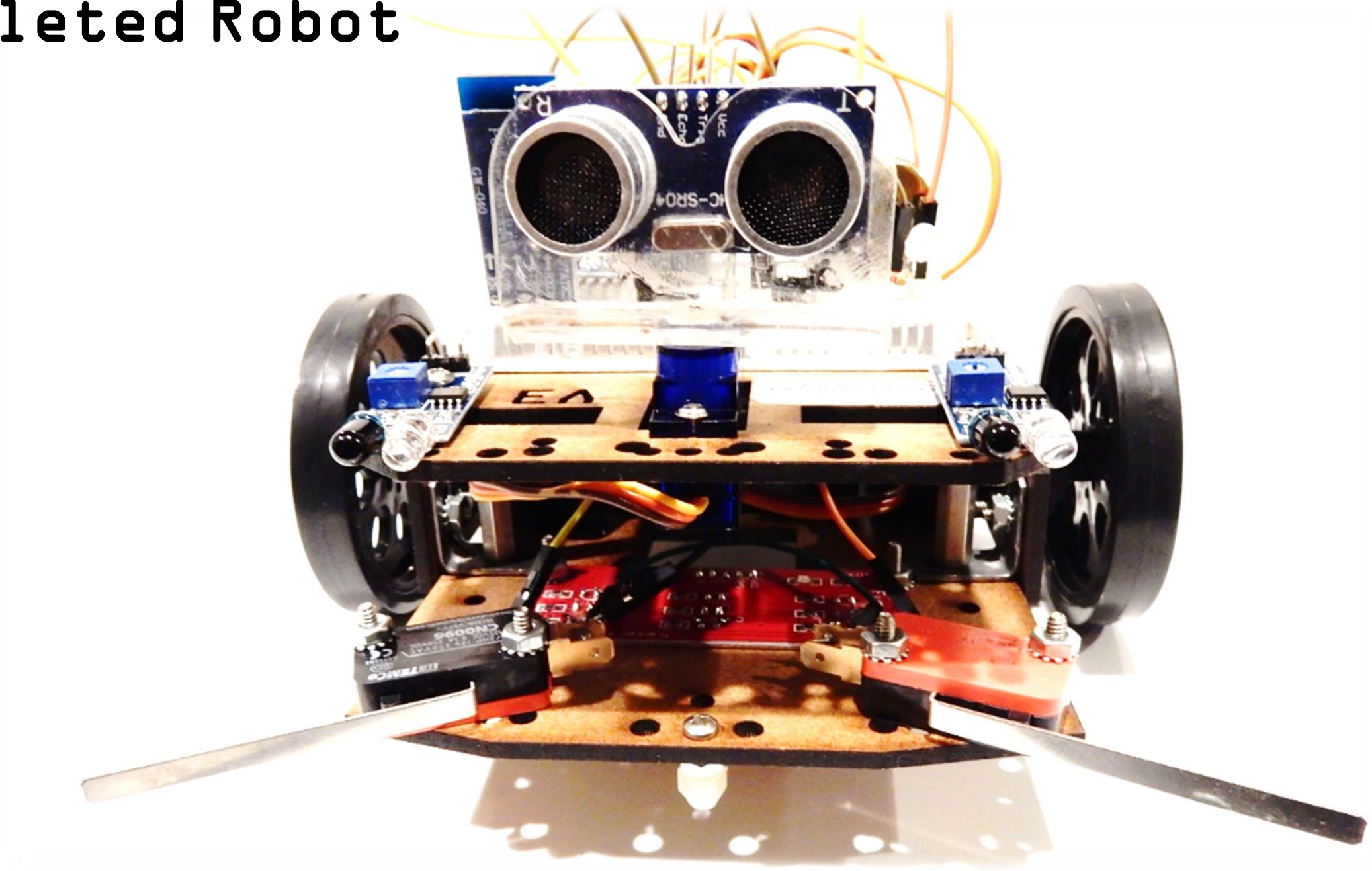
Completed Robot



Completed Robot

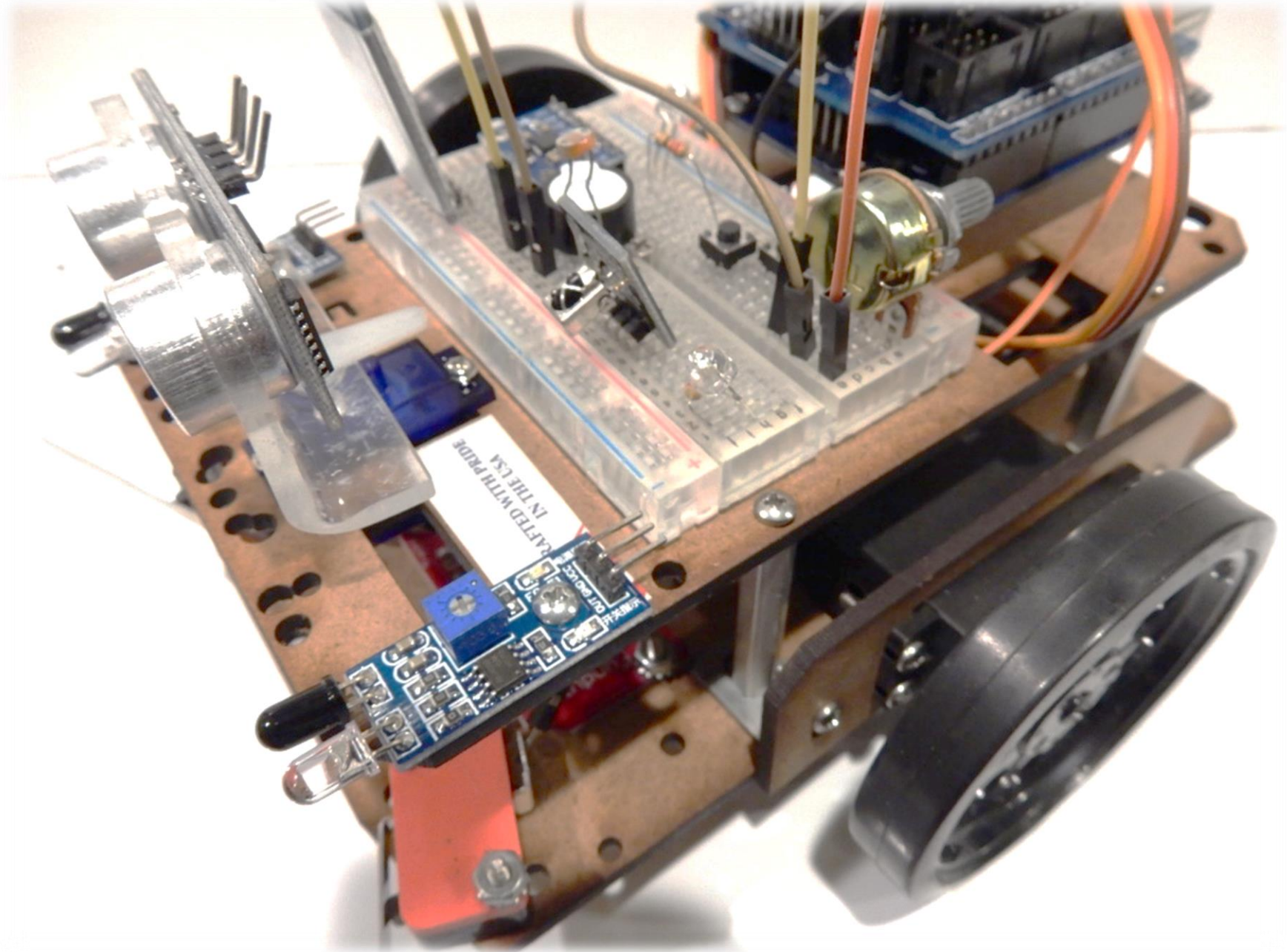


Completed Robot

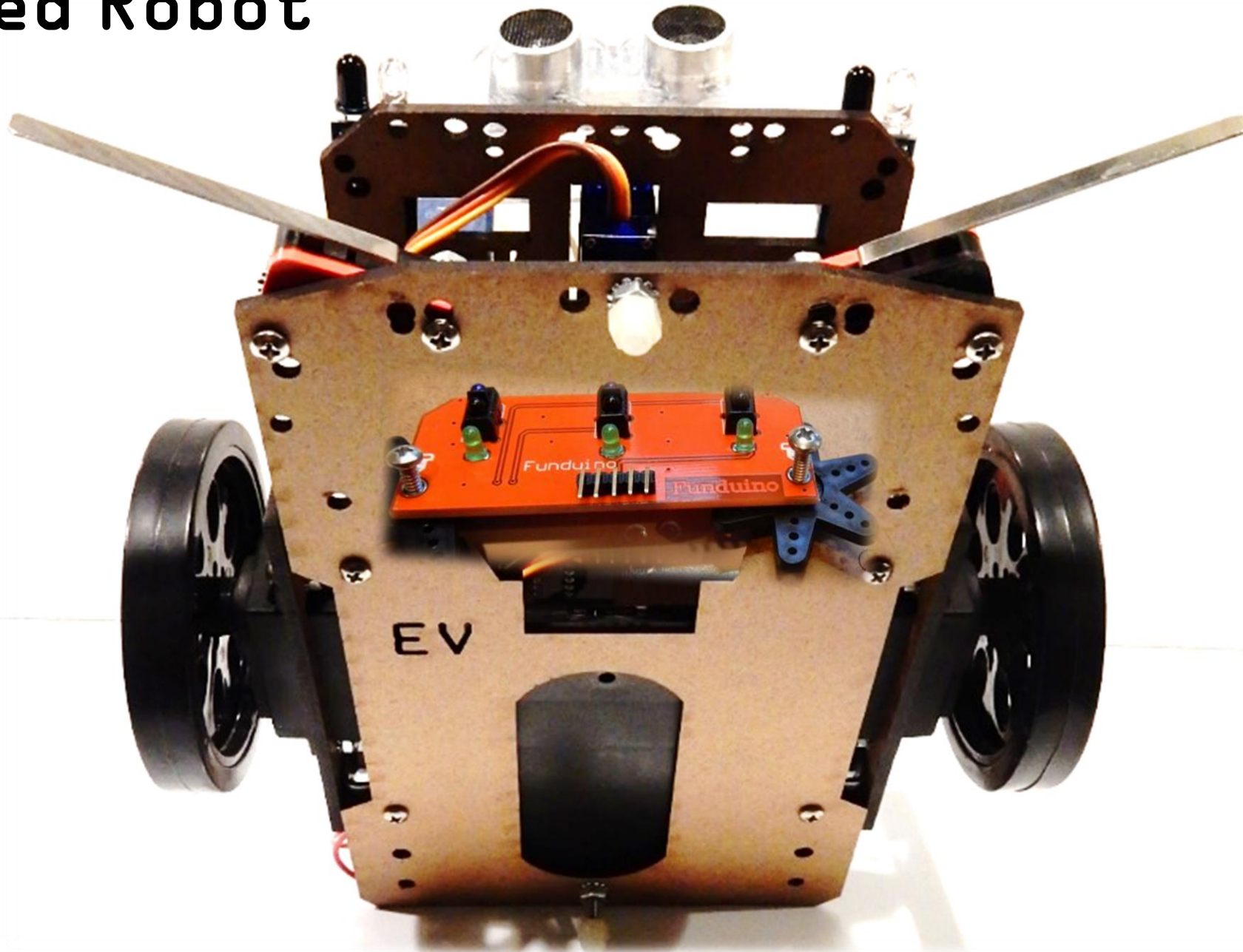


A custom-built electronic device, possibly a robot, is shown. It features a breadboard with various components including a microcontroller, memory modules, and sensors. The device has two large black wheels and is connected to a power source via a USB cable. The breadboard contains a blue microcontroller board, a black memory module labeled "Power288", and a blue sensor module. The device is mounted on a wooden base.

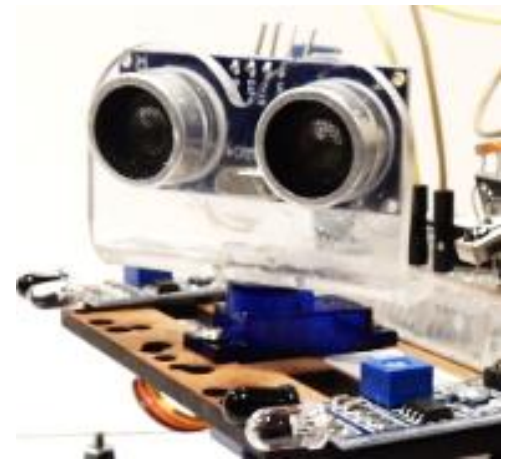
Completed Robot



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 <http://www.roboticscity.com/> to download these exciting projects.

Have FUN!