

Four-Wheeler Vehicle

Procedure:











First gather all required parts list in the materials section below. The notations next to some parts in the materials list (ex. -9, -11, -15) are the stud lengths of that part. Then using the construction guidelines, build the vehicle. The guidelines are split into separate sections for each part of the vehicle and these sections will be combined together in later stages of construction. The sections are listed below. Figure 1 shows the completed four-wheeler.

1. Transmission
2. Rear Motor Mount
3. Front Motor Mount
4. Frame Assembly
5. Mounting the Motors
6. Final Assembly



Figure 1: Completed picture of the four wheeler

Materials: From the LEGO Mindstorms Education NXT Base Set

Qty	Part Name	Part Image			
1	Beam 1x13 Straight	 -13	4	Wheel 43.2x22 without Pinholes	
2	20cm NXT cable		4	Gear 24-Tooth	
4	Axle Joiner Perpendicular		2	Gear 40-Tooth	
4	Axle Joiner Perpendicular w/ 2 Holes		2	Gear 8-tooth	
1	Beam 1x11 Straight	 -11	4	Lift arm 1x11.5 Double Bent	
4	Beam 1x15 Straight	 -15	2	Beam 1x3 Straight	 -3
2	Beam 1x9 Straight	 -9	2	Beam 2x4 L Shape	
2	Beam 1x5 Straight	 -5	16	Long Pin with Friction	
2	Beam 1x7 Straight	 -7	8	Long Pin with Stop Bushing	
4	Beam 3x5 L Shape		1	NXT Computer	
2	Blue Axle Pin with Friction		14	Pin with Friction and Slots	
6	Bushing		4	Size 2 Axle Notched Red	
2	Electric Motor		4	Size 3 Axle	 -3
4	Gear 16-Tooth		6	Size 5 Axle	 -5
4	Yellow 1/2 Bushing Smooth		4	Size 6 Axle	 -6
			4	Tire 56x26 Balloon	

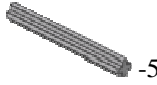



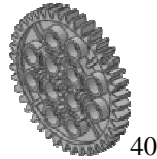

Transmission

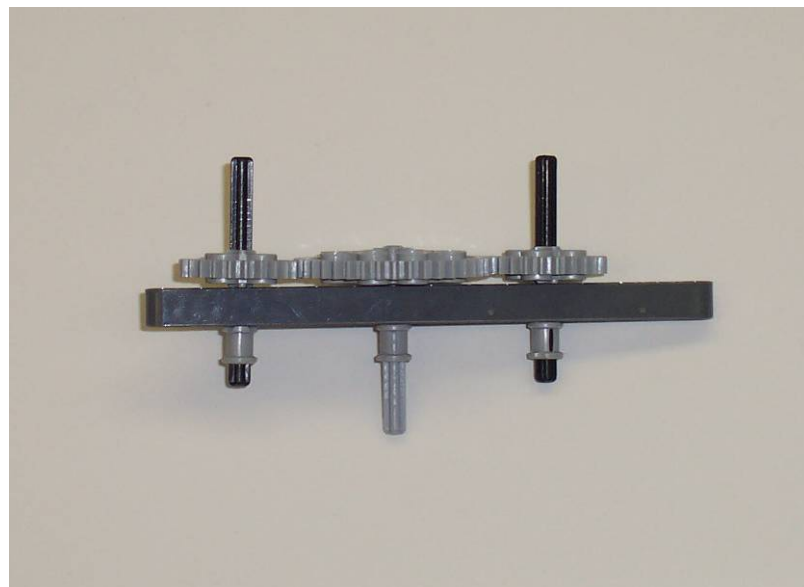
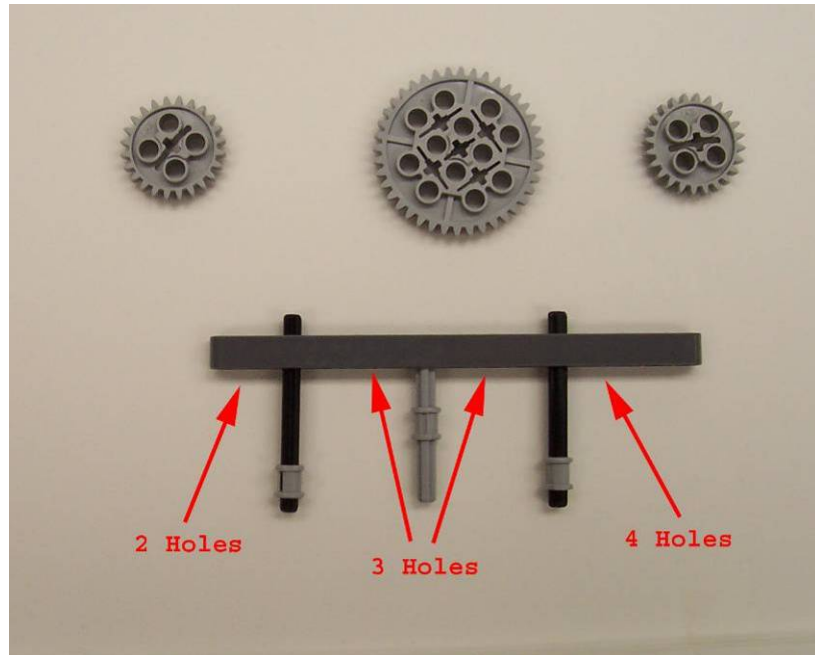
This section describes how to assemble two identical transmissions. The transmissions are used to transfer power from the motor to the wheels through a set of gears. This setup allows all four wheels to have power running to them. Note that the parts list in each step is for *both* transmissions.

Step 1:

Assemble the axles and transmission gears as shown in the image. Note the position of the bushings on the axles. The teeth of the gears should mesh. The larger 40-tooth gear placed between the other 24-tooth gears allows power from the motor to go to all four wheels.

Parts:


Qty	Part
2	 -5
4	 -6
6	
4	 24
2	 40
2	 -15

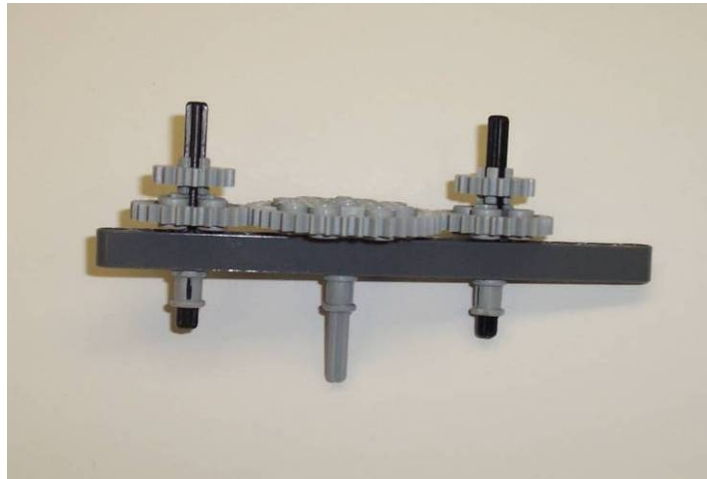


Step 2:

Place the 16-tooth gears on the axles as shown

Parts:




Qty	Part
4	 16



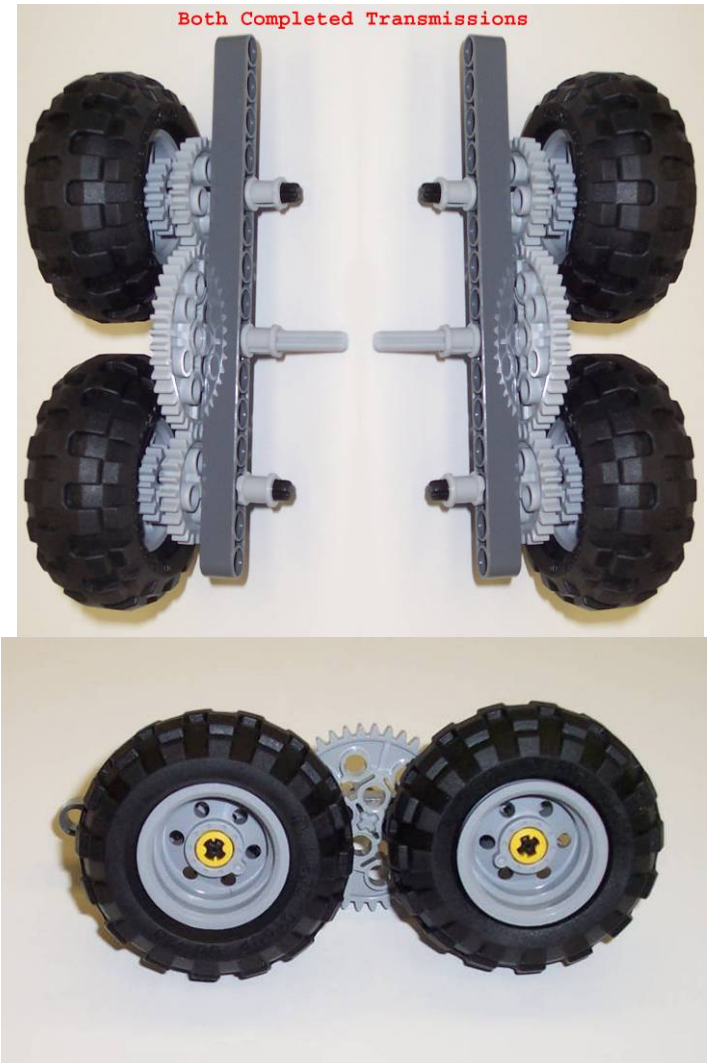
Step 3:

Assemble the wheels and place them on the axles. Attach the yellow 1/2 bushings to secure them in place. This completes the transmission assemblies. Set both aside until later.

Parts:

Qty	Part
4	
4	
4	

Repeat steps 1 through 3 for the second transmission.







Rear Motor Mount

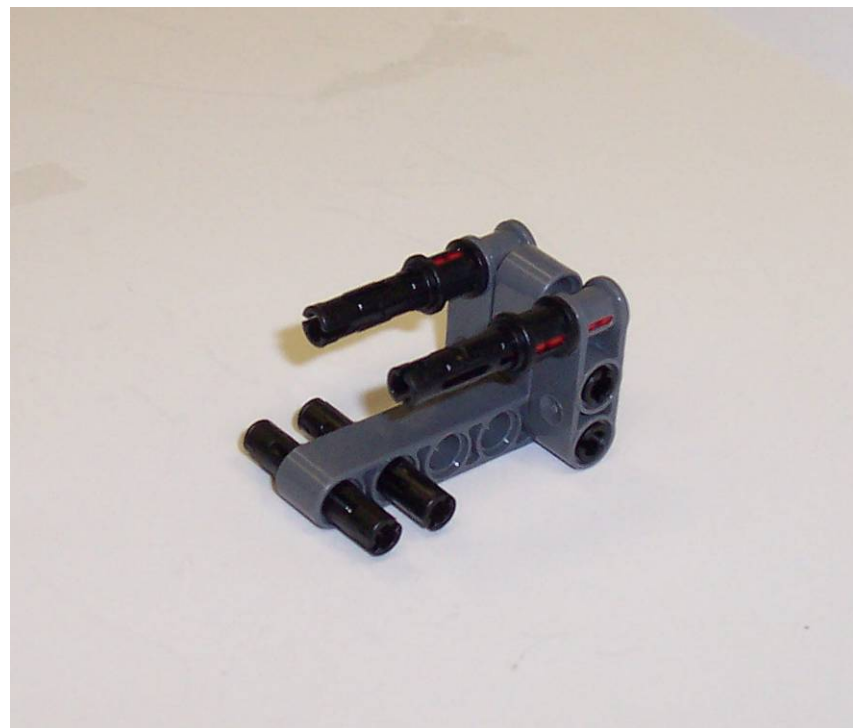
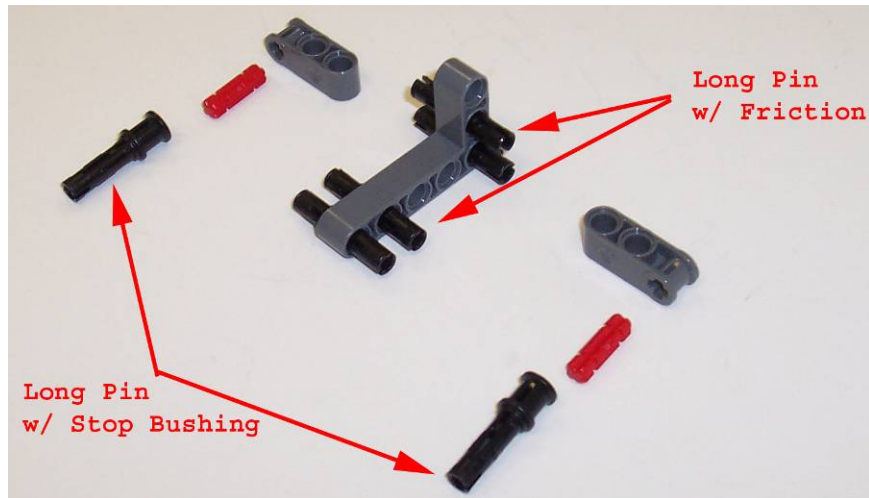
This section gives instructions for building two identical rear motor mounts. The rear motor mounts provide support for the weight of the motor and a stable connection between the motor and the frame of the vehicle. The parts list includes everything needed for both rear motor mounts.

Step 1:

Put together the rear mounting bracket as shown. The first picture shows an exploded view and the second an assembled view. The axle joiners are connected in two places each to increase the strength and stability of the part and to prevent the pieces from rotating.

Parts:

Qty	Part
8	
4	
4	
2	
4	



Front Motor Mount




This section details how to assemble the front motor mount. This module serves a similar purpose as the rear motor mount by providing support and stability in the vehicle. There are mounts at both the front and rear to provide the most support for the motor. Two front motor mounts will be made; they are mirror images of each other to accommodate opposite sides of the vehicle and these changes are noted in the steps below. The parts lists include the pieces needed for both front motor mounts.

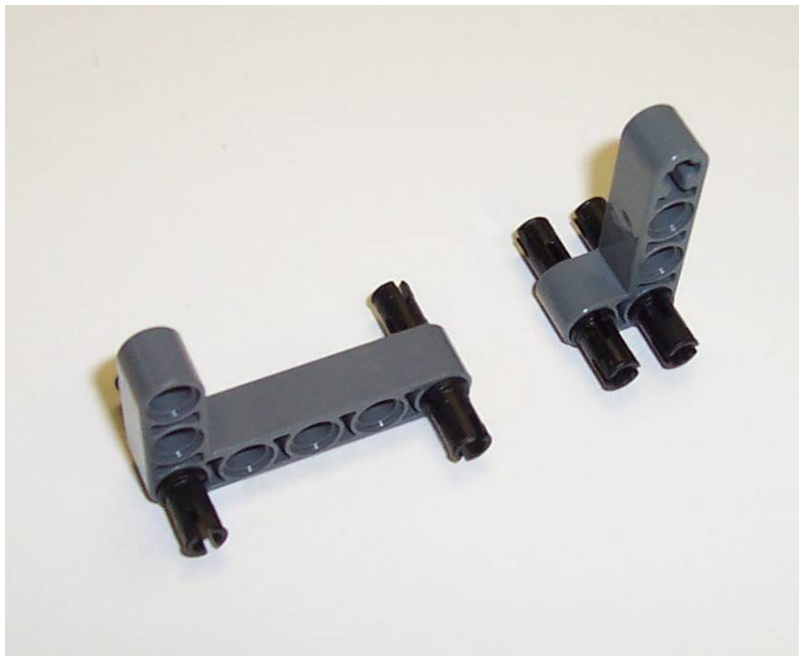
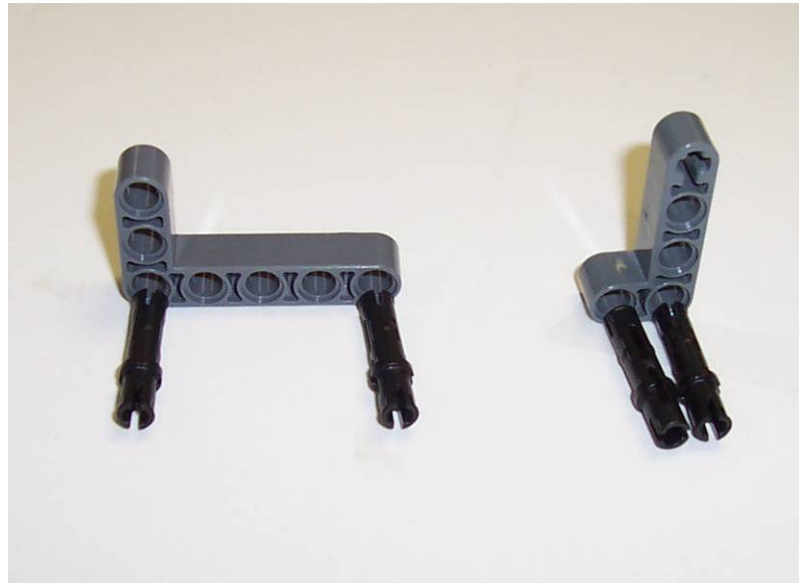
Step 1:

Place the four long pins through the holes shown in the two L beams.

Note: The second front mount will be a mirror image of the first.

Parts:


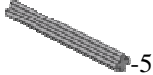


Qty	Part
8	
2	
2	

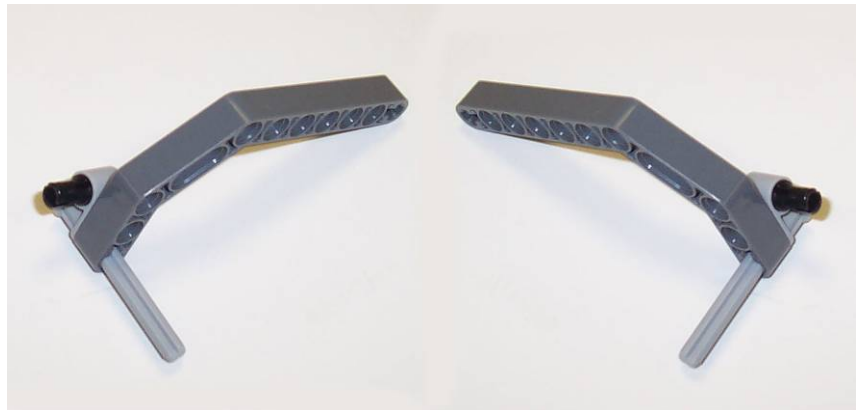


Step 2:

Assemble together the friction pin, axle joiner, and size 5 axle as shown. Slide the axle through the last hole on the shorter section of the 1x11.5 double bent beam.

Parts:

Qty	Part
2	
2	
2	
2	

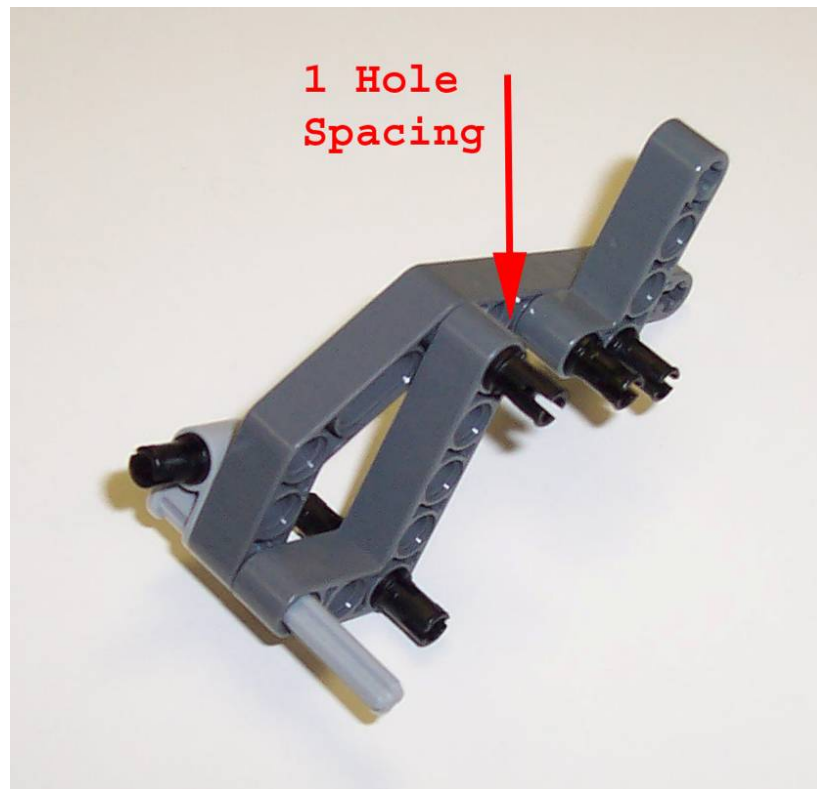


Step 3:

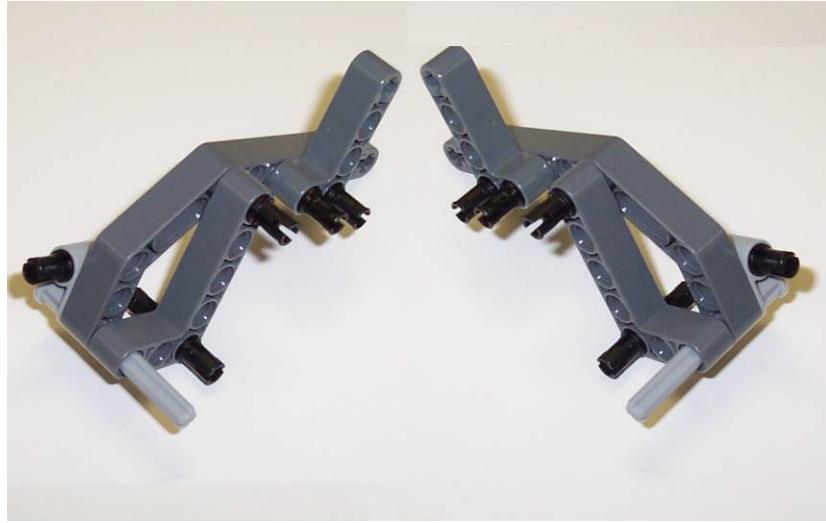
Slide the 3x5 L beam on to the axle and connect the top with the pin to the double bent beam. Attach the 2x4 L shape to the double bent beam.

Note: The second front mount will be a mirror image of the first. It is shown in the last image.

No new parts are needed for this section.



Both finished front motor mounts.






Frame Assembly

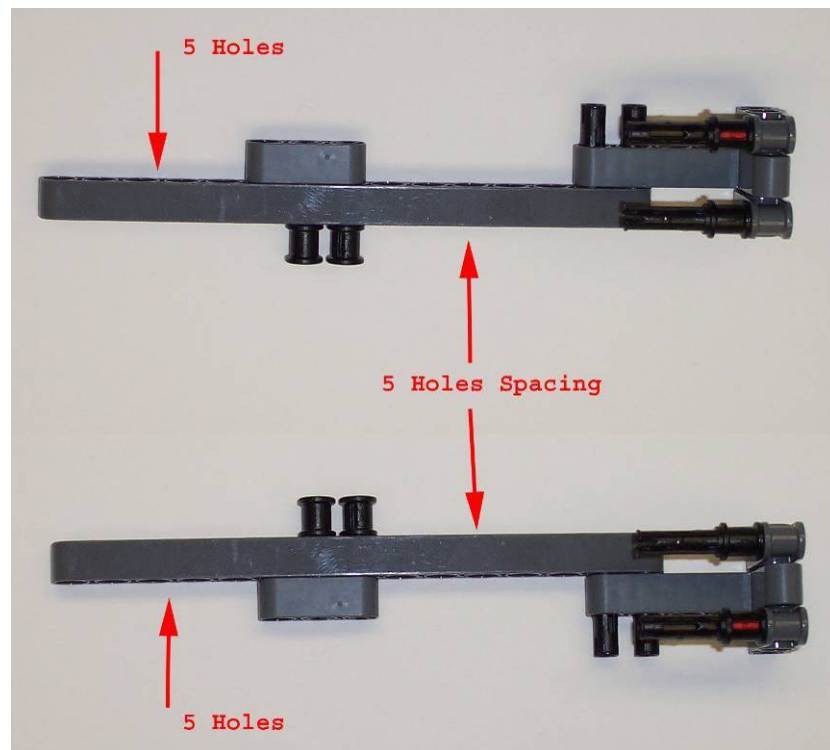
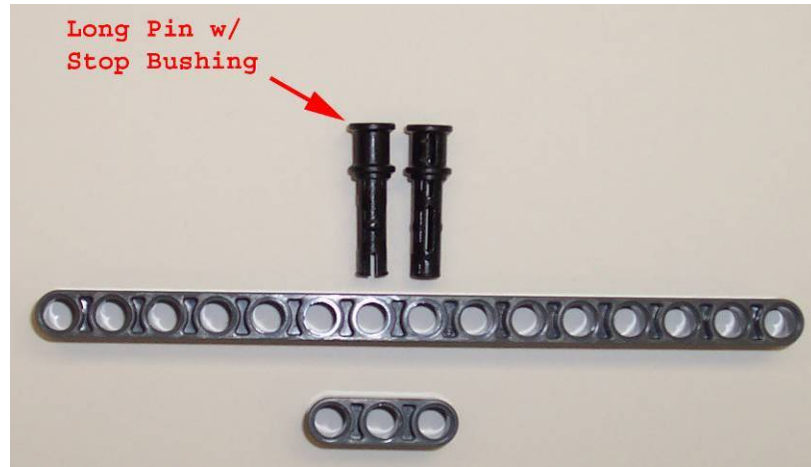
This section demonstrates how to assemble the frame and connect the front and rear motor mounts to it. This provides the platform of the entire vehicle. You will need both of the front and rear motor mounts as well as the parts listed in this section to assemble the frame. Two frame sections will be constructed, but will be different as noted in the steps below.

Step 1:

Push the long pins through the 1x15 beam and then attach the 1x3 beam to those. Connect the rear motor mount as shown in the picture. The second side will be a mirror of the first and is shown in the images.

Parts:

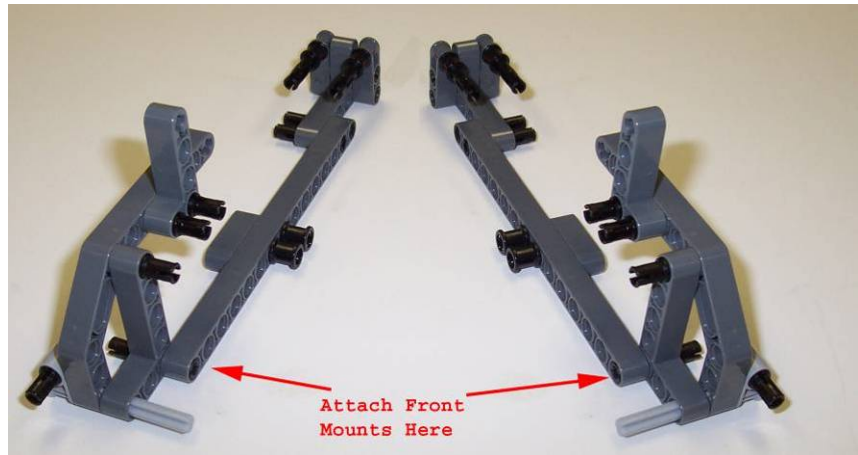
Qty	Part
4	
2	 -3
2	 -15



Step 2:

Attach the front motor mounts on to the 1x15 beam. They will attach in the first hole on the same side as the 1x3 beam from the last step using the pin on the lower part of the front motor mount. This will be done for both sides; they will be mirror images of each other.

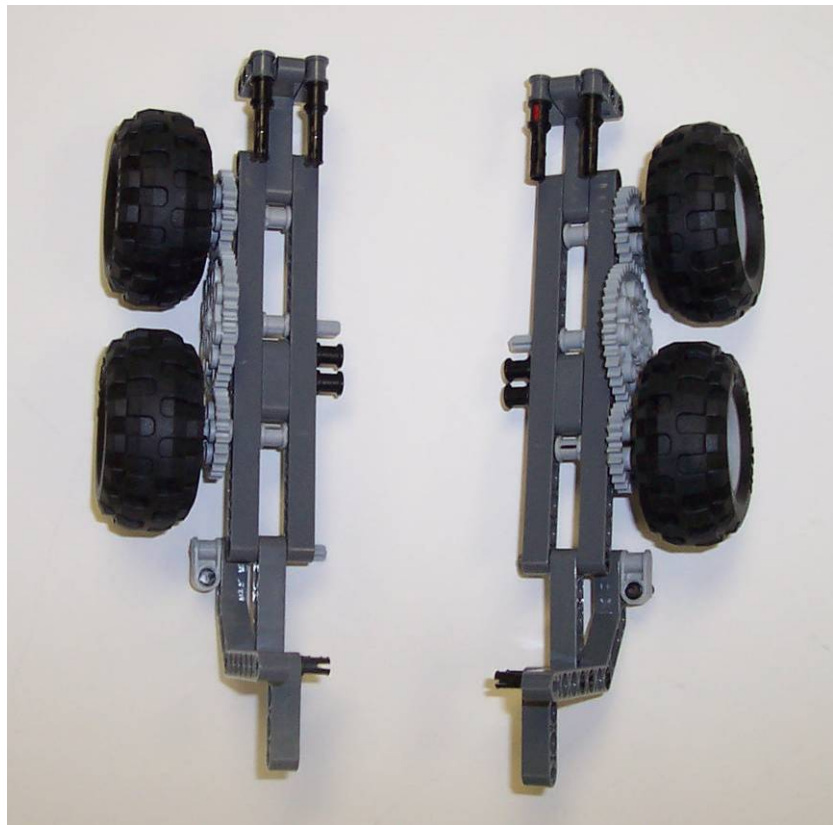
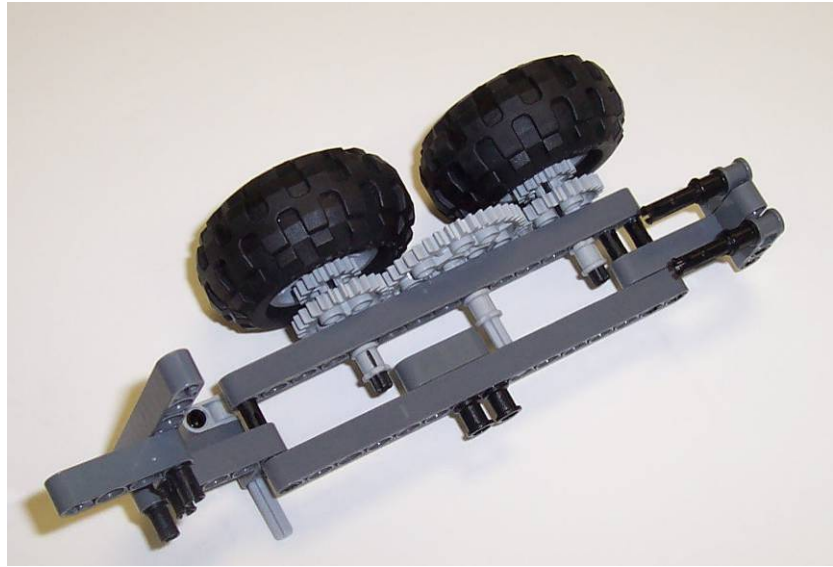
No new parts are needed for this section.



Step 3:

Attach a pair of wheels to each frame section. It does not matter which wheel piece goes to which side, but the end with 4 extra holes on the beam should be towards the front. The two sides will be mirror images once again.

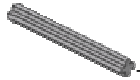

No new parts are needed for this section.

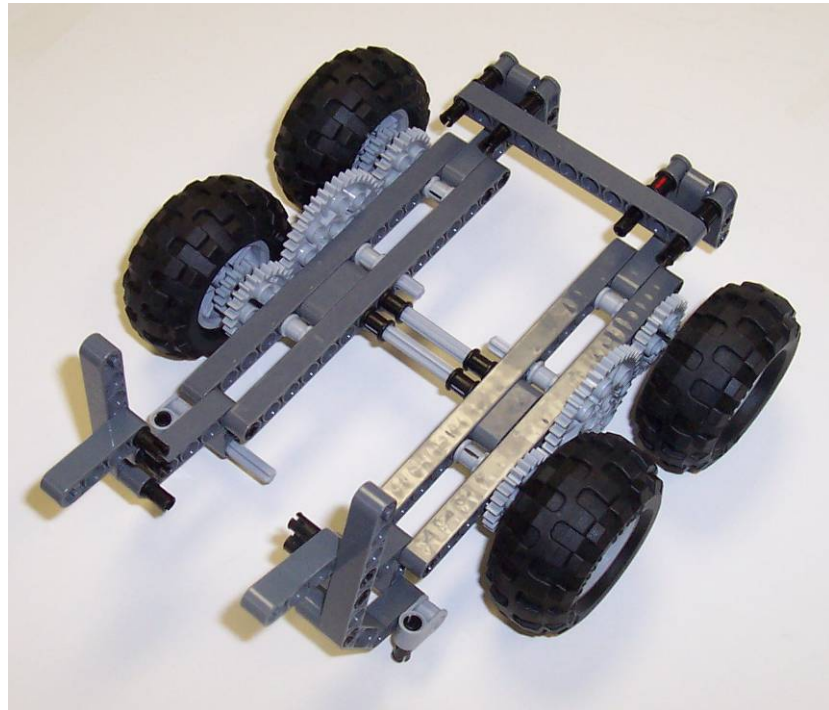
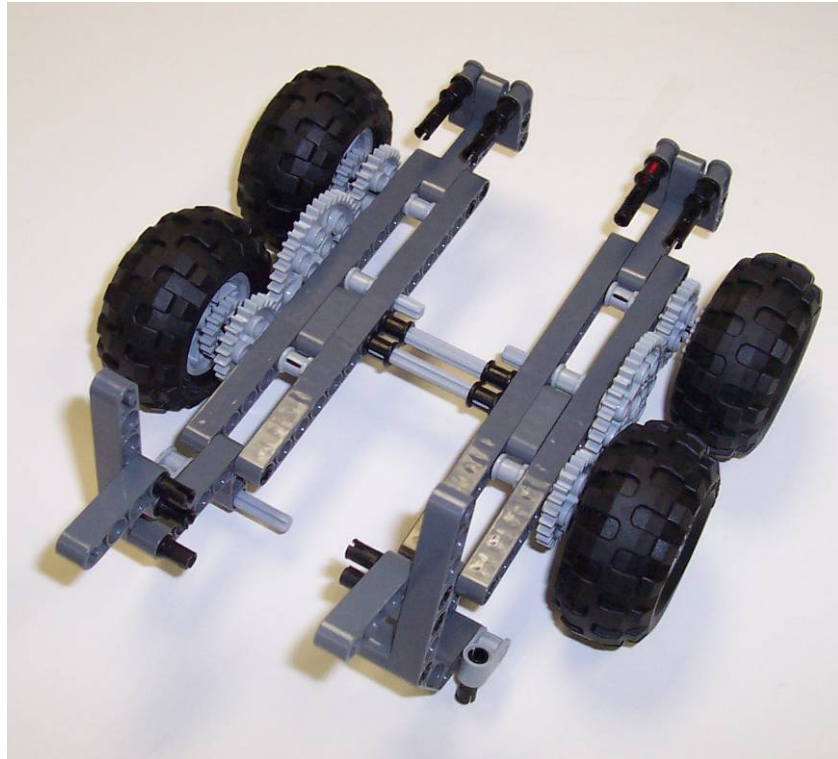


Step 4:

Connect the two halves using size 5 axles between the long stop pins on either side. Then slide the 1x11 beam on to all four front-facing long pins on the rear motor mounts.

Parts:

Qty	Part
2	 -5
1	 -11




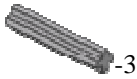

Mounting the Motors

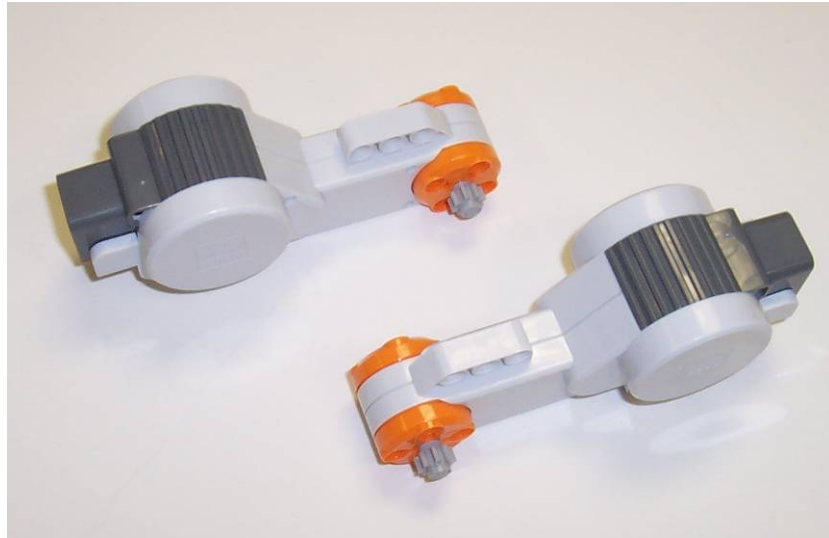
This section describes how to mount the motor onto the frame of the vehicle. This will provide the power for the vehicle. Each motor will power two wheels. Two motors will be assembled, one for each side of the vehicle. Differences between the two sides will be noted. The parts lists contain everything needed for both motors.

Step 1:

Attach the 8-tooth gear to the size 3 axle and insert it into the center of the orange section. This gear will transfer the power from the motor to the wheels. For the second motor the 8-tooth gear should be placed on the other side.

Parts:

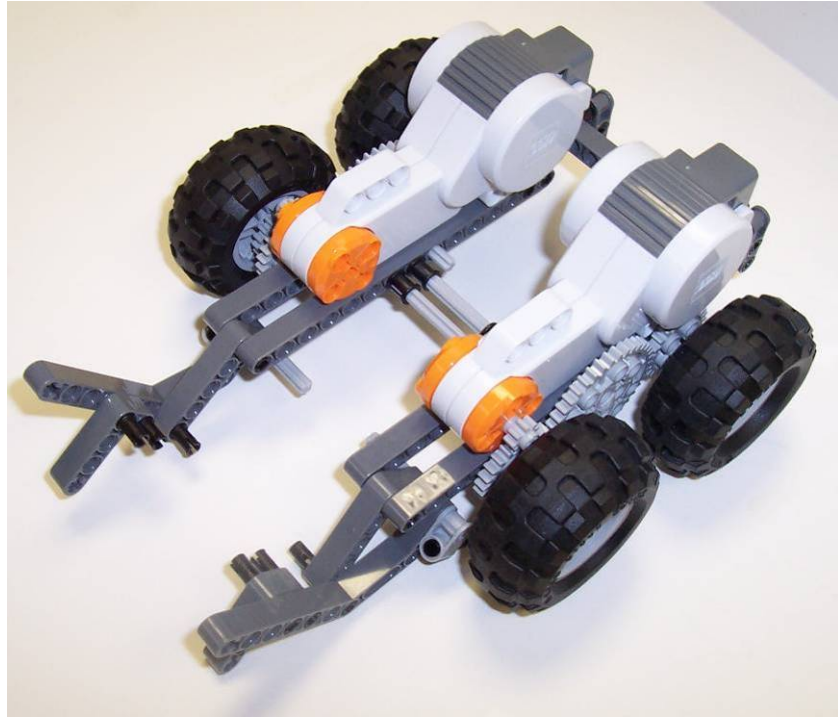
Qty	Part
2	
2	 -3
2	



Step 2:

Attach the motor to the rear motor mounts by sliding it backwards on to the forward-facing pins that stick out. The 8-tooth gear should sit directly on top of the front-most 24-tooth gear. This connection is important for transferring power from the motor to the wheels. Install the second motor on the other side.




No new parts are needed for this step.

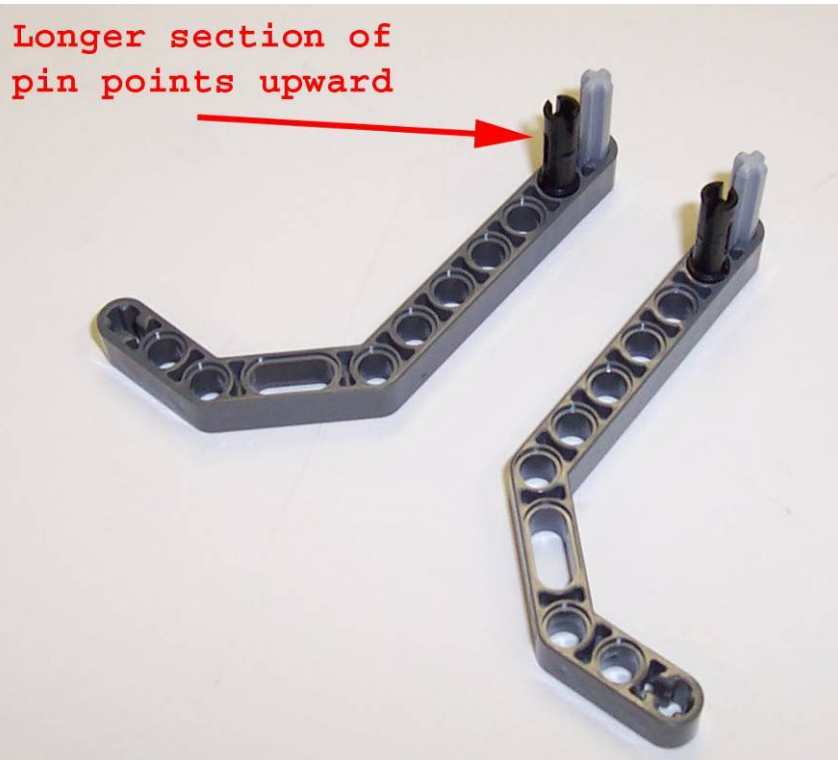
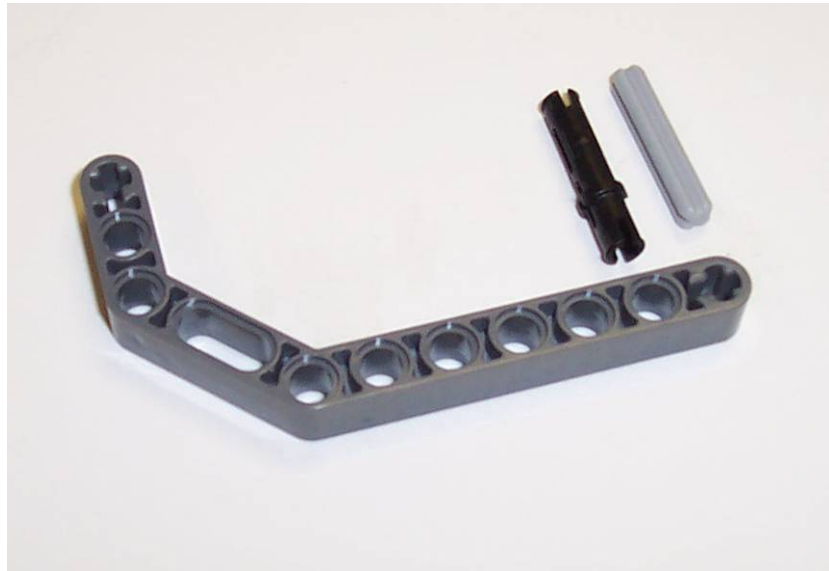


Step 3:

Assemble the two arm modules as shown. They will be used to secure the motor to the frame and front mounts.

Parts:

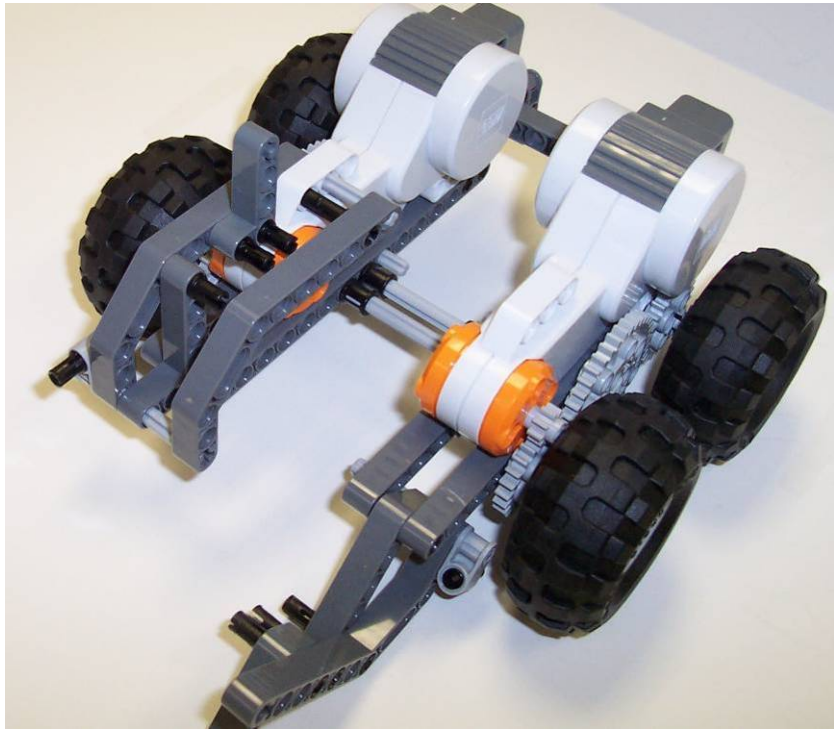
Qty	Part
2	
2	 -3
2	



Step 4:

Swing the front motor mount up and back until it lines up with the front two holes on the top of the motor. Take the arm modules from the last step and slide them on to the front motor mount from the inside. The long pin and axle will connect to the other 1x11.5 bent beam through two holes on top of the motor. This will be done on both sides.

No new parts are needed for this step.






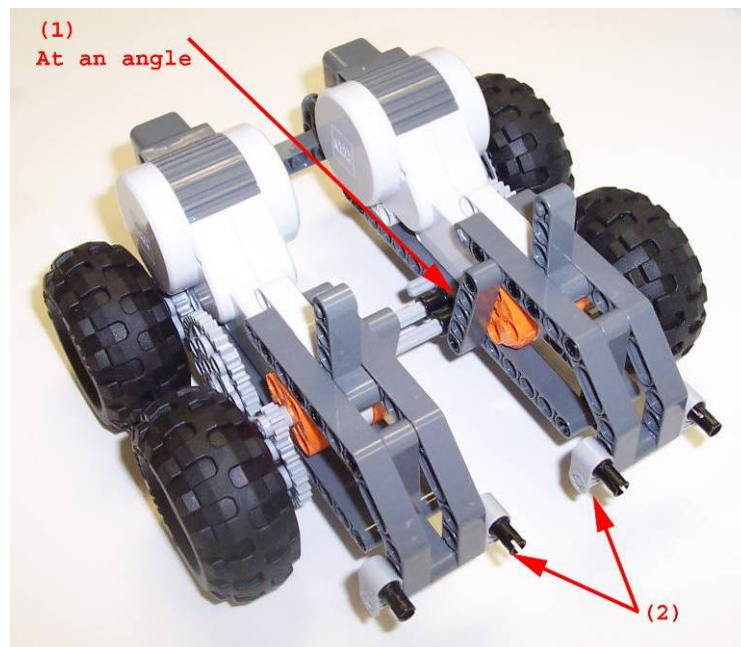
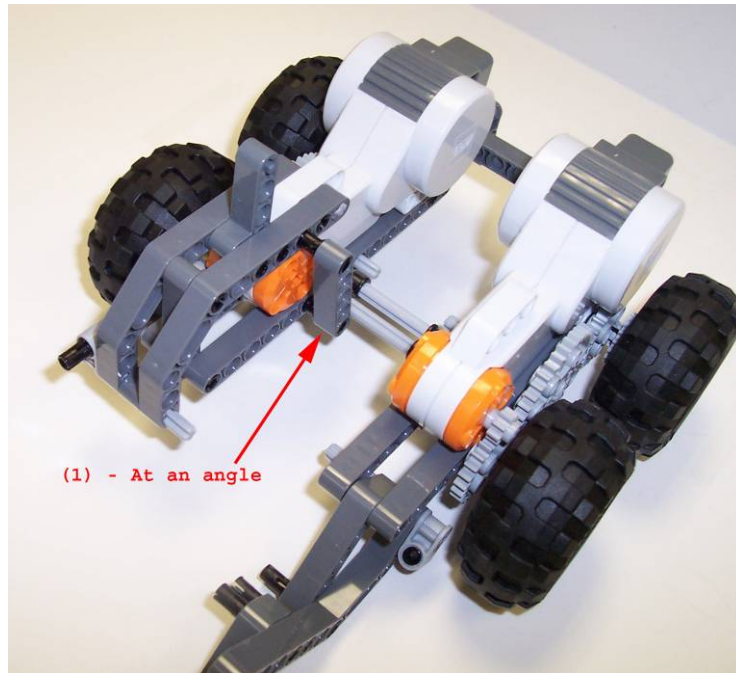
Step 5:

Create two tie rods by placing pins at both ends of a 1x5 straight beam. Make two more bumper supports by attaching pins to two axle joiners.

Attach the tie rods on the inside of the vehicle between the 3rd hole from the end of the 1x11.5 beam at the motor end and the hole next to the cross members on the 1x15 straight beam. Attach the bumper supports to the inside of the front motor mounts using the excess axle sticking out. This will be done for both sides.

Parts:

Qty	Part
6	
2	 -5
2	






Final Assembly

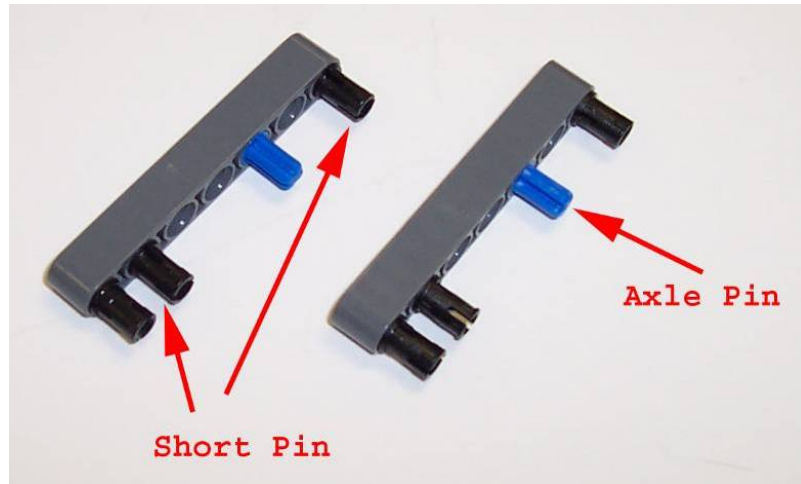
This section covers mounting the NXT computer and hooking it up to the motors to complete the vehicle.

Step 1:

Create the two connection pieces to attach the NXT computer to the vehicle.

Parts:

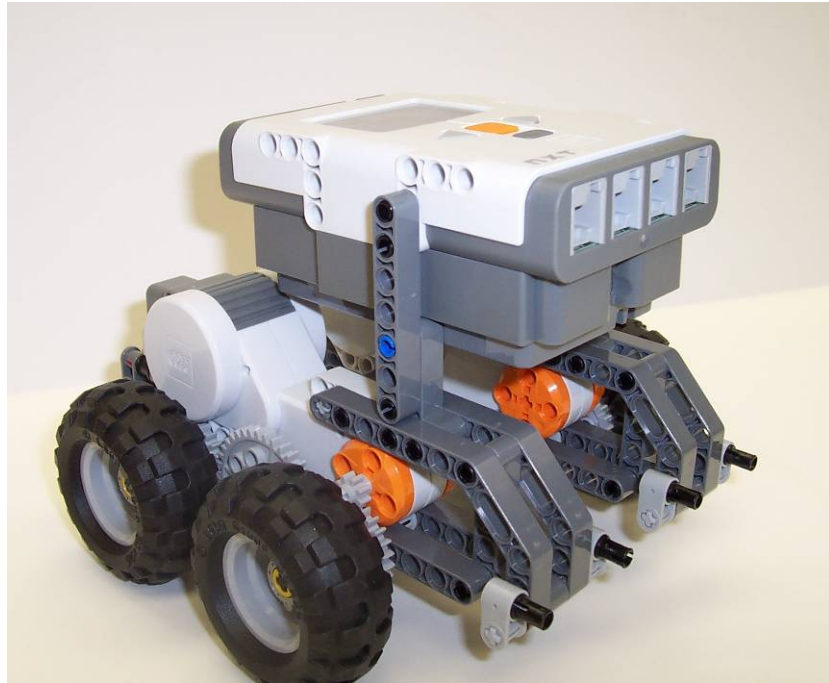
Qty	Part
6	
2	
2	 -7




Step 2:

Insert the battery into the NXT brick and then continue this step.

Place the computer on the uprights of the front motor mounts as shown, Attach one of the beam assemblies created in the last step to each side of the computer and connect it to an upright. You will need to attach it to both the computer brick and the uprights at the same time.




Parts:

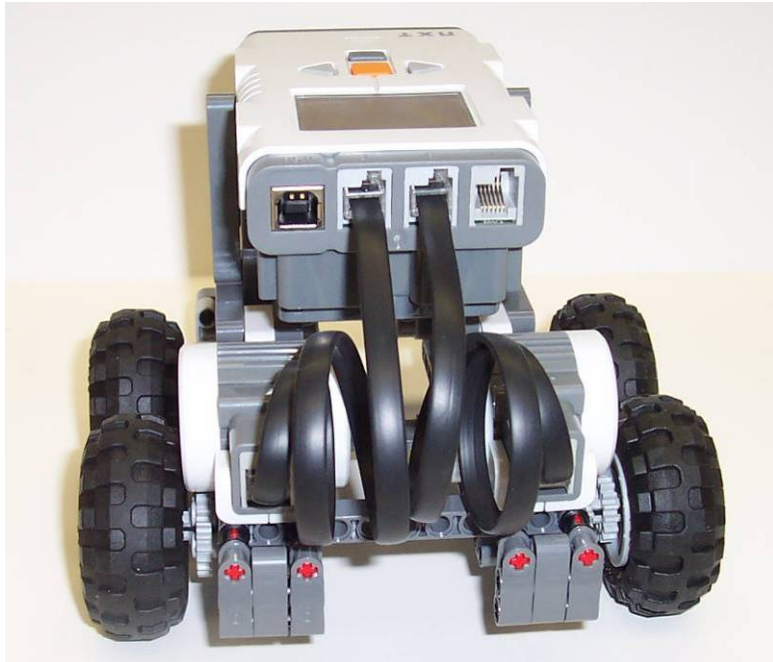
Qty	Part
1	

Step 3:

Attach two NXT cables, one from each motor to a plug on the top of the NXT computer. This allows data to be transferred from the computer to the motor. The right motor is plugged into the B port, and the left in the C.

Parts:


Qty	Part
2	

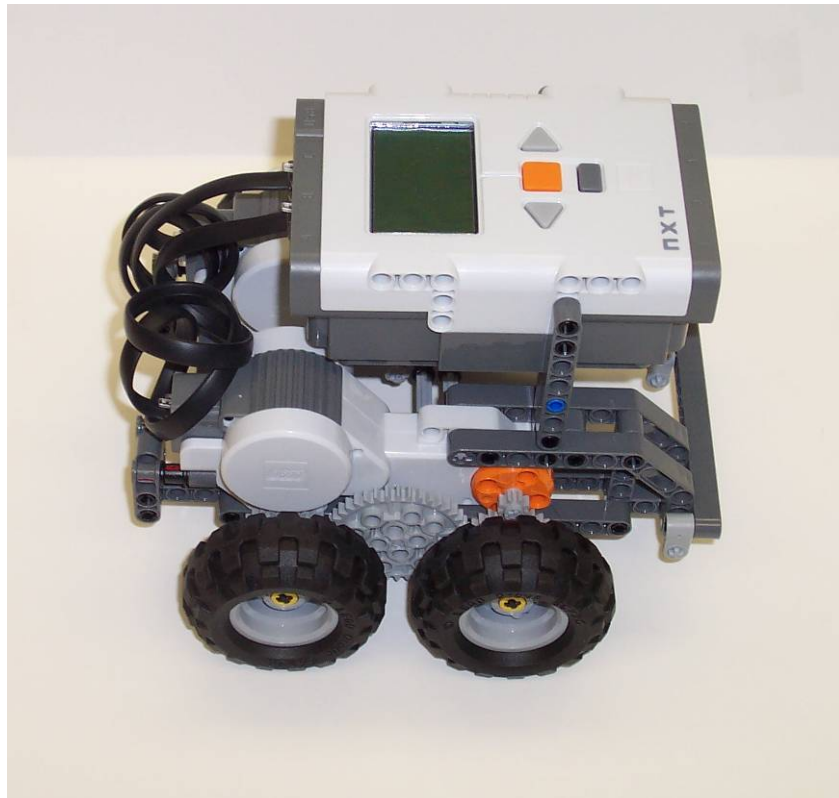
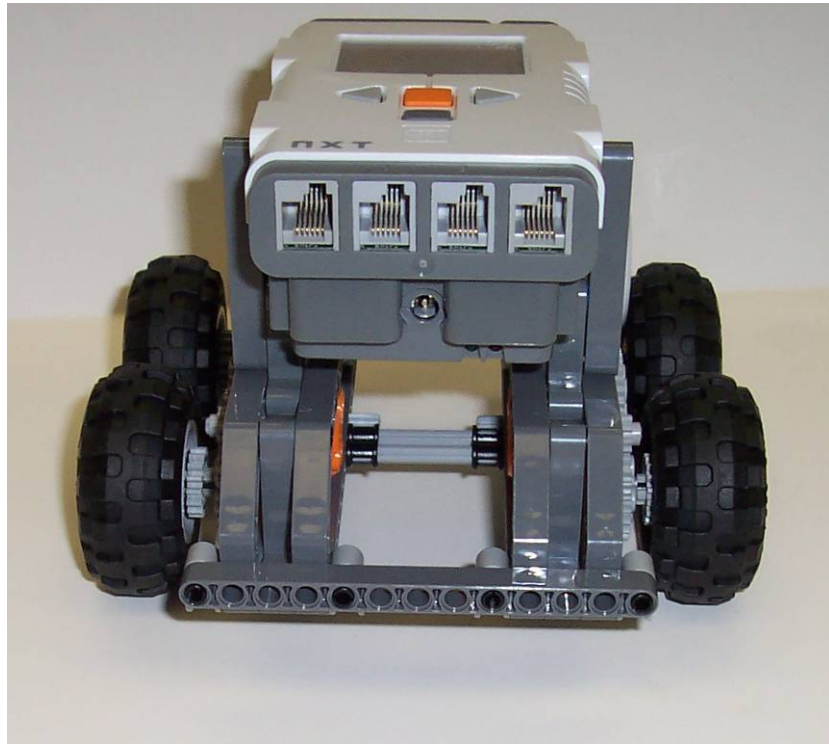


Step 4:

Attach the 1x13 straight beam to the front motor mounts to make the front bumper. This bumper helps prevent twisting of the frame around the cross members and provides some impact protection.

Parts:



Qty	Part
2	 -13



Step 5:

Attach the 3 pins with friction to the 1x9 beam as shown. Connect it from the last hole available on the top of the motor to the side of the computer. This will give a stable platform for the computer to sit on. Repeat this step for the opposite side to complete the construction of the four-wheeler.

Parts:

Qty	Part
6	
2	 -9

