

Roger the Robot

Roger is a durable, 4-wheel drive robot that works well for robot games. Use Roger as the base and add other parts needed for competitions. Or build Roger to learn how to use gears and bracing in your own designs.

These robot plans were developed by Dr. ChanJin Chung and Joe Engalan. Dr. Chung is a professor at Lawrence Technological University in Southfield, Michigan. He is an expert robot competitor, and organizes a robot competition called RoboFest each April.



Now that you've built Bobo, run a few tests with it. Did you notice some of the things that make Bobo a good design? Did you notice some of Bobo's disadvantages? Bobo doesn't always go straight. Sometimes Bobo seems to go too slowly. Well, if speed and stability are more important than maneuverability or the ability to change modules on the fly, then we'll teach you how to make your second robot, Roger. Roger was designed to be more stable than Bobo. Roger was also designed to have a little more speed. You want to watch out however, sometimes Roger can go too fast for its sensors. Roger would be a good choice in games where agility isn't as important as stability. Roger is based on a 4-wheel drive design. This makes it able to follow a straight line. However, because of the stable 4-wheel design, Roger doesn't turn as fast as Bobo.

STRUCTURE 1: AXLES

Because we'll use the same axle components for all 4 wheels, we can save time by making them up front.

To create the axles you'll need the following parts:

Quantity	Color	Item Description
4	Black	Axle 6
8	Gray	1/2 Bushings



Step 1. Put 2-1/2 Bushings on the end of an Axle 6.



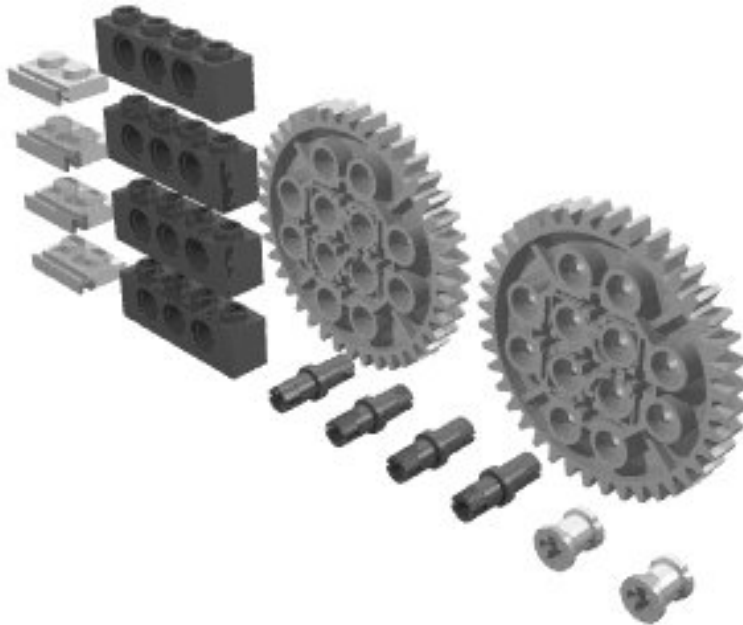
Step 2. Repeat step 1 for all of the axles.

STRUCTURE 2: REAR WHEEL MOUNTS

Roger's wheels are all connected to the frame by wheel mounts.

To create the rear wheel mounts you'll need the following parts:

Quantity	Color	Item Description
4	Black	1x4 Beam with Holes
4	Black	Friction Pin
4	Gray	1x2 Plate with Motor Mounts
2	Black	Axle Studs (from previous step)
2	Gray	40 Tooth Gear
2	Gray	Bushings



Step 1. Place 2 friction pins in the holes of a 1x4 beam. Leave the center hole empty.



Step 2. Attach another 1x4 beam to the pins creating a solid block.

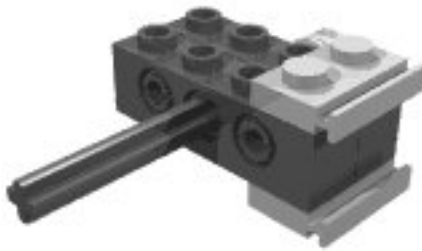


Step 3. Finish off by adding 2-1x2 motor mount plates to one end of the block.



Step 4. Repeat steps 1 through 3 to create an identical wheel mount.

Step 5. Now place an axle stud through the hole in the center of the block as shown.



Step 6. Slide a 40-tooth gear down the axle stud and lock it down with a bushing. Make sure the stud and gear can spin freely.



Step 7. Repeat steps 5 and 6 to create a **mirror** image of the wheel mount.



STRUCTURE 3: REAR FRAME

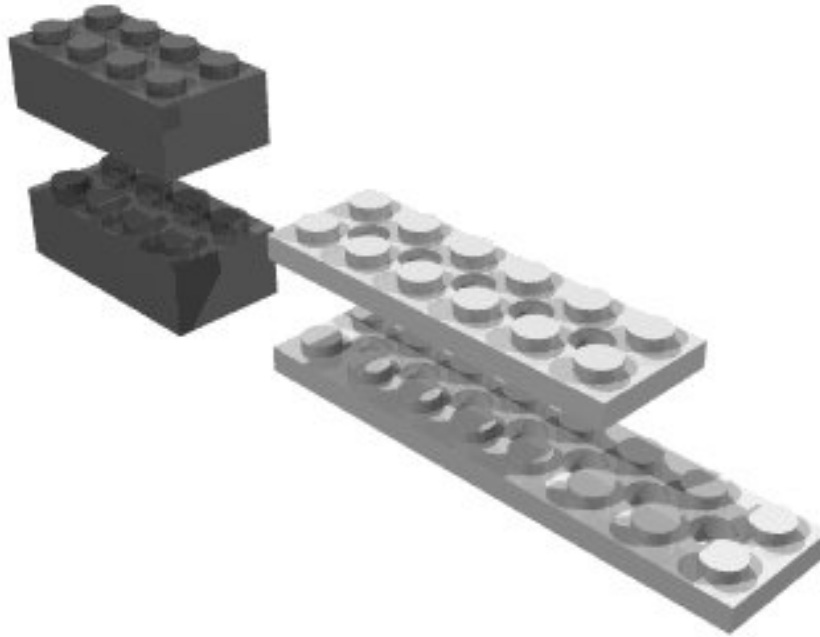
Roger's body is divided into 3 parts:

- Rear Frame
- Motors
- Front Frame

In this step, we'll create the Rear Frame.

To create the rear frame you'll need the following parts:

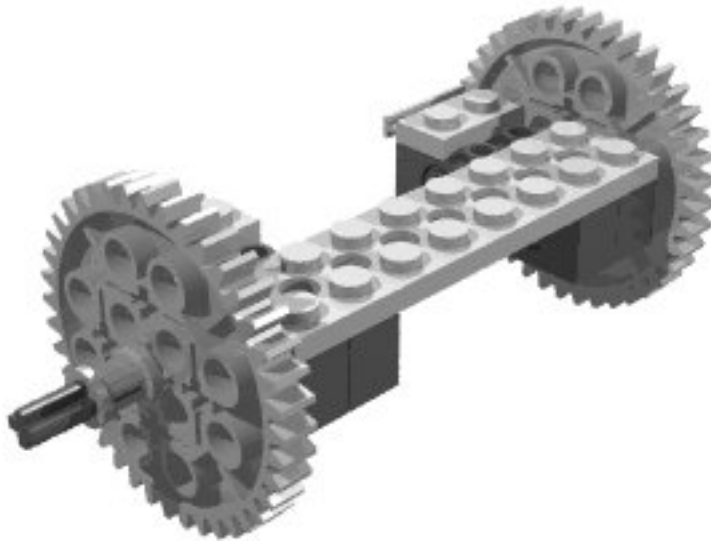
Quantity	Color	Item Description
1	Gray	2x8 Plate With Holes
1	Gray	2x6 Plate With Holes
2	Black	2x4 Bricks
2	Black	Rear Wheel Mounts (from previous step)



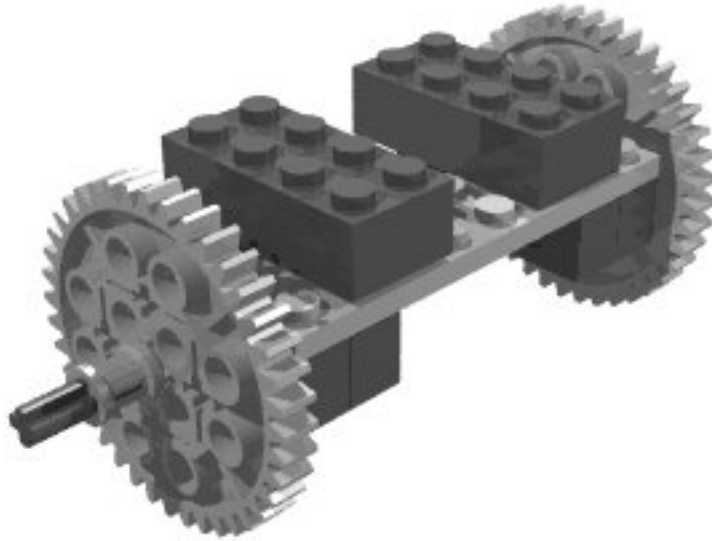
Step 1. Attach the 2x8 Plate to one of the Rear Wheel Mounts as shown.



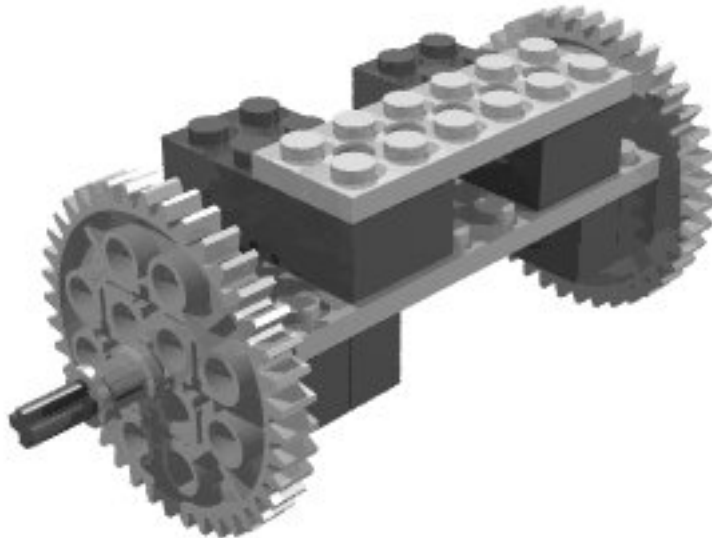
Step 2. Attach the mirrored wheel mount as shown.



Step 3. Now attach the 2-2x4 Bricks as shown, making sure to leave a 2-stud gap between them.



Step 4. Now cap the bricks using the 2x6 plate. The plate should go on the side that is free of motor mounts as shown.



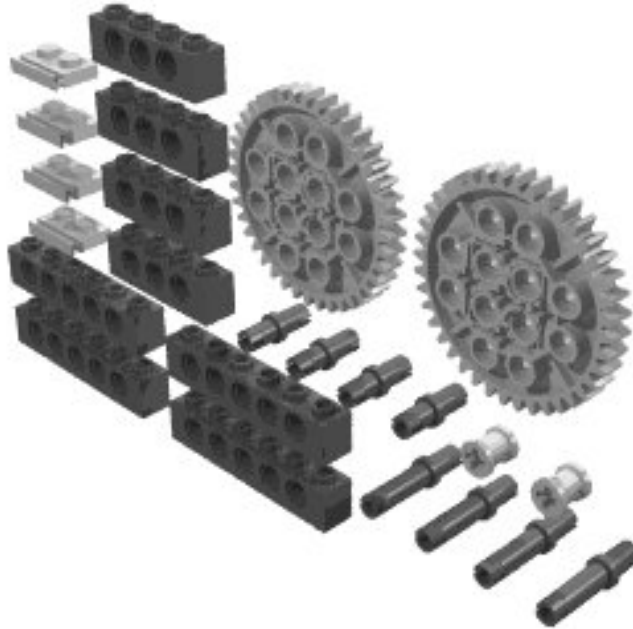
Now we've completed Roger's rear chassis, let's move on to the front side.

STRUCTURE 4: FRONT WHEEL MOUNTS

Before moving onto Roger's front frame, we need to make a couple of Front Wheel Mounts. These are similar to the Rear Wheel Mounts, but we need to add extra framing for the front sensor extension.

To create the front wheel mounts you'll need the following parts:

Quantity	Color	Item Description
4	Black	1x4 Beam with Holes
4	Black	1x6 Beam with Holes
4	Gray	1x2 Plate with Motor Mounts
2	Black	Axle Studs (from previous step)
4	Black	Friction Pin
4	Black	Long Friction Pin
2	Gray	40 Tooth Gears
2	Gray	Bushings



- Step 1. Add 2 friction pins to one of the 1x6 beams. Place them in holes 1 and 3, leaving hole 2 free to accept an axle stud later on.



Step 2. Add another 1x6 beam to the pins making a solid block.



Step 3. Complete this part of the wheel mount by adding 2-1x2 plates with motor mounts. Put them on the side with the pin. This is will be the side closest to the motors.



Step 4. Repeat steps 1 through 3 to create an identical wheel mount.

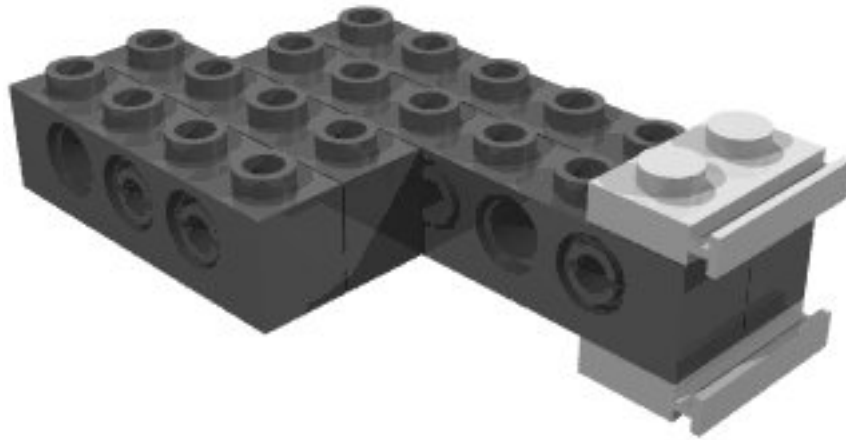
Step 5. Now push 2 long friction pins into holes 4 and 5.



Step 6. Push one 1x4 beam onto the long friction pins. Push the pins through holes 1 and 2 on the 1x4 beam as shown.



Step 7. Cap it off with another 1x4 beam. Again, push the pins through holes 1 and 2 on the 1x4 beam as shown.



Step 8. Now take one of the axle studs and push it through hole 2 as shown.



Step 9. From the other side, push down a 40-tooth gear onto the axle stud and lock it in place with a bushing. Turn the axle to make sure it can turn freely.



Step 10. Repeat steps 5 through 9 on the other wheel mount to create a **mirror** image of this wheel mount.

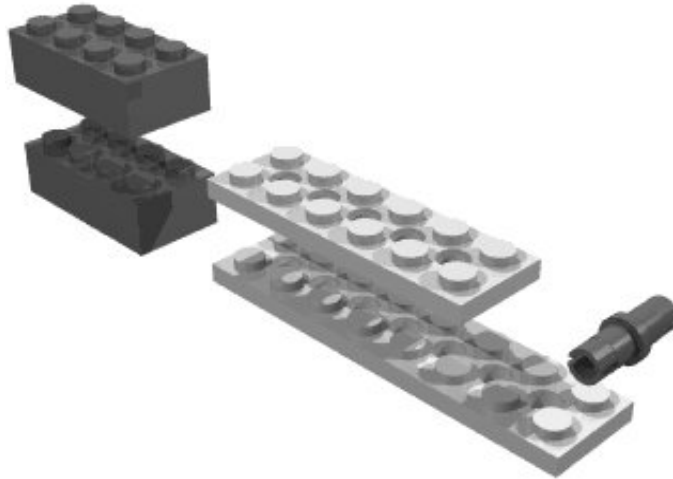


STRUCTURE 5: FRONT FRAME

Now we'll work on Roger's front chassis.

To create the front frame you'll need the following parts:

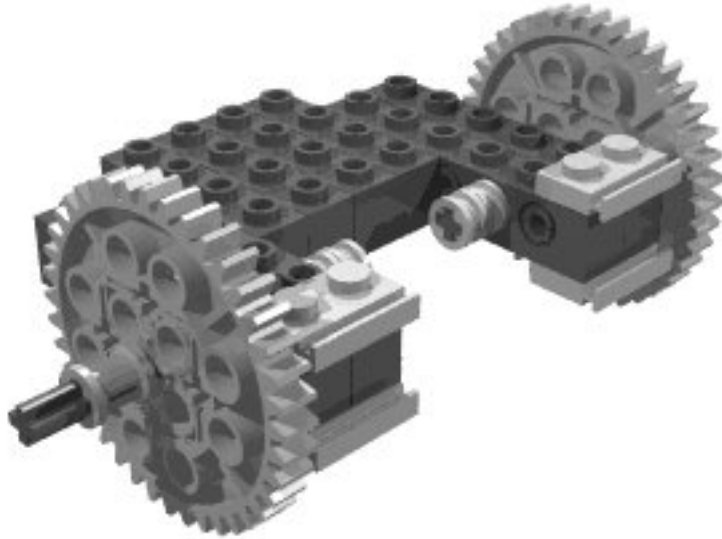
Quantity	Color	Item Description
1	Gray	2x8 Plate With Holes
1	Gray	2x6 Plate With Holes
2	Black	2x4 Bricks
2	Black	Front Wheel Mounts (from previous step)
1	Black	Friction Pin



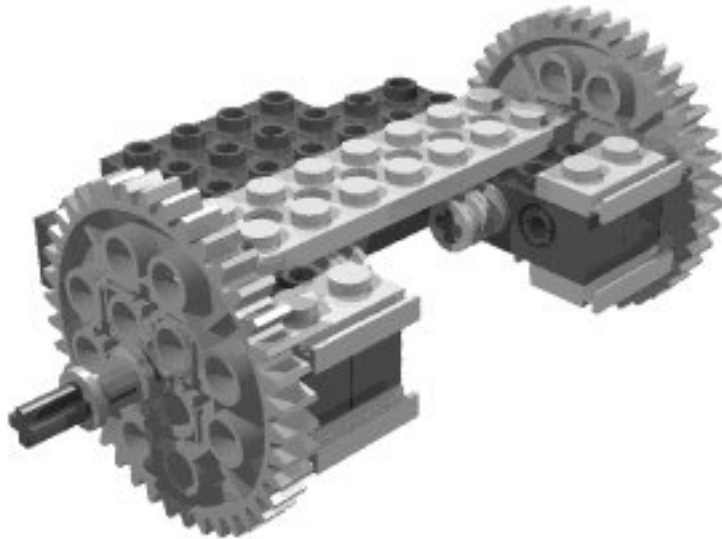
Step 1. First take one of the Front Wheel Mounts and place the pin in the hole last hole on the 1x4 beam.



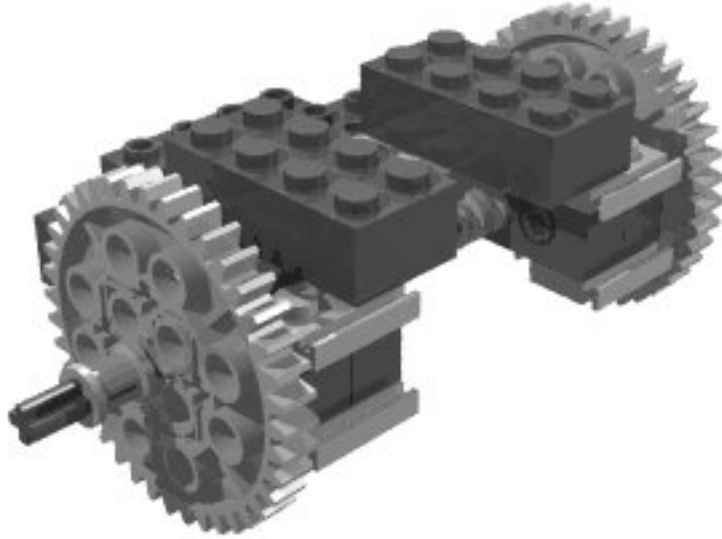
Step 2. Now attach it to the other front wheel mount using the exposed pin.



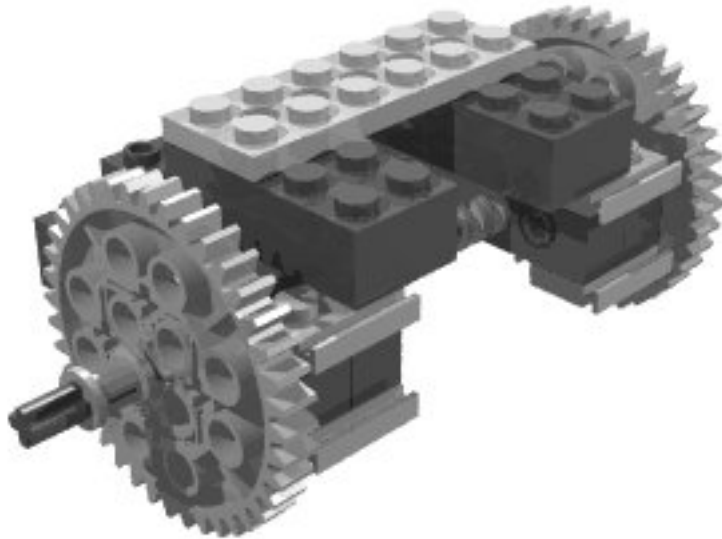
Step 3. Now place the 1x8 beam across the 2 wheel mounts as shown. This will add strength and stiffness to the overall assembly.



Step 4. Just like you did for the Rear Wheel Mounts, add 2-2x4 bricks to the assembly leaving a 2-stud gap between them.



Step 5. Finish off the chassis by adding a 2x6 beam across the top of the bricks.



STRUCTURE 6: MOTORS

Now that we have the front and rear chassis, let's put together the motors.

For the motor assembly you'll need the following parts:

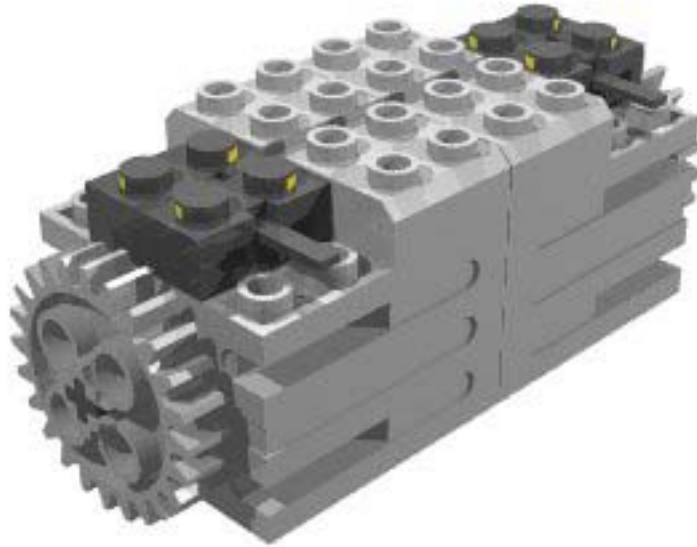
Quantity	Color	Item Description
2	Gray	Technic 9V Mini Motor
2	Gray	24 Tooth Gear
1	Yellow	2x4 Plate



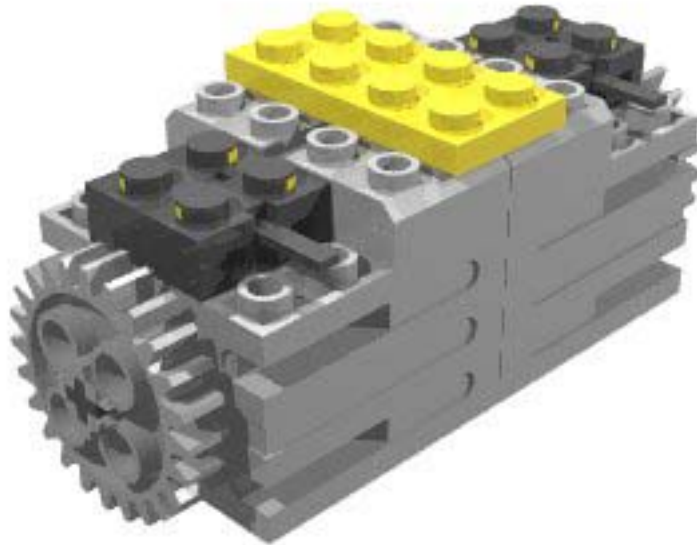
Step 1. First, put the 24-Tooth gears on the motors.



Step 2. Next, line the motors back to back. Also, attach 2 short wires to the motors. Make sure the wires point in the same direction as shown. We'll call this direction the rear of the robot.



Step 3. Place the 2x4 plate across the top seam of the motors as shown. This isn't very strong yet, but when we attach the chassis, the frame will stiffen nicely.



We're done with the motors for now. All we have to do now is attach the front and rear assemblies and we're done with the frame.

STRUCTURE 7: FRAME

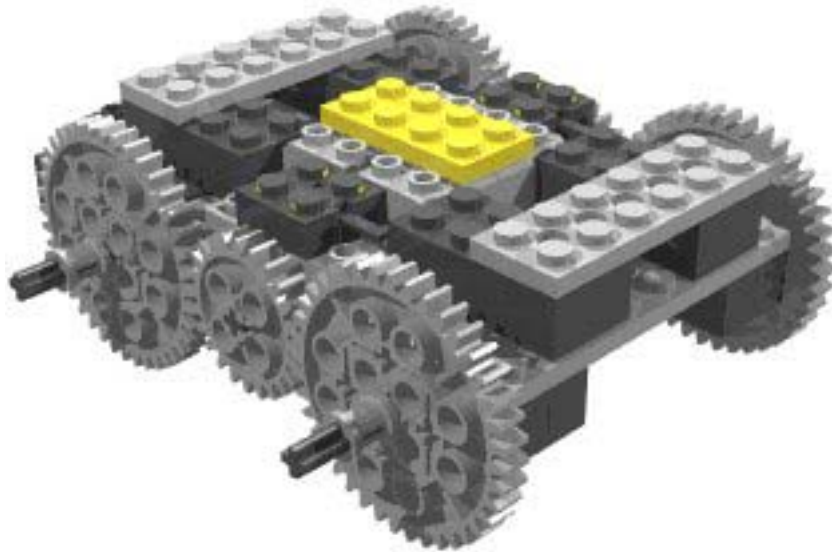
We've got all the pieces for the frame. All that's left is putting it together

To build the frame you'll need the following parts:

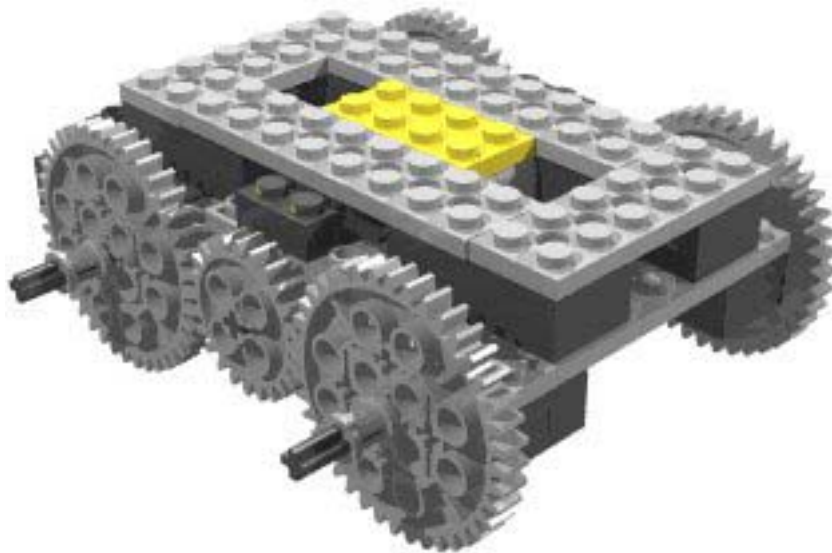
Quantity	Color	Item Description
1	Black	Rear Frame Assembly
1	Black	Front Frame Assembly
1	Gray	Motor Assembly
4	Gray	2x8 Plate With Holes
2	Gray	1x8 Plate



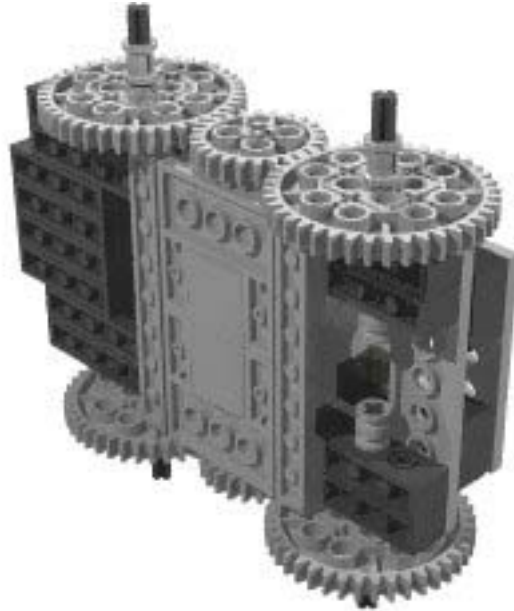
Step 1. Slip the front and rear chassis into the slits of the motor assembly. Remember that the wires are facing the rear of the robot. They don't lock together, but we'll add braces to support and strengthen the frame.



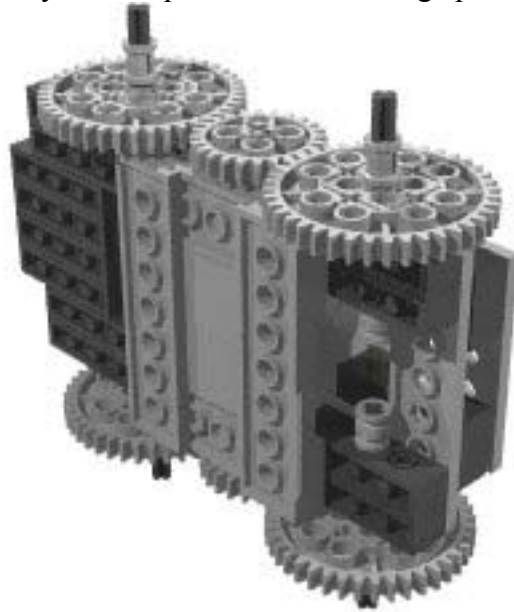
Step 2. Now we'll add the braces to the top. Place 2-2x8 plates across the 2x4 bricks on the front and rear chassis. The plates should also snap into the wire connector and motor.



Step 3. Now flip Roger's frame over so that we can brace the bottom. Place 2-1x8 plates across the 1x2 as shown.



Step 4. Now place 2-2x8 plates across the 1x8 and motors. This will strengthen the motor assembly and keep them from twisting apart.



Now we've finished Roger's frame. We're almost done.

STRUCTURE 8: BUMPER

Bobo can't do much if he can't react to his environment. In this section, we'll create a basic bumper that will allow Bobo to detect objects in front of him.

For this step you'll need:

Quantity	Color	Item Description
1	Black	2x4 L-shaped Lift Arm
1	Black	Axle 6
1	Gray	Touch Sensor With Wire
2	Black	Bent Lift Arms
2	Gray	Lift Arms
2	Gray	Cams
2	Gray	Angle Connector #5
4	Gray	1/2 Bushings
4	Black	Axle 4



Step 3. First attach a wire to the touch sensor. I suggest attaching it sideways, as shown.



Step 8. Attach 2 Axle 4 to a cam and push it through the hole in the touch sensor.



Step 9. Now add 2 1/2 bushings and the L-shaped lift arm to the top axle.



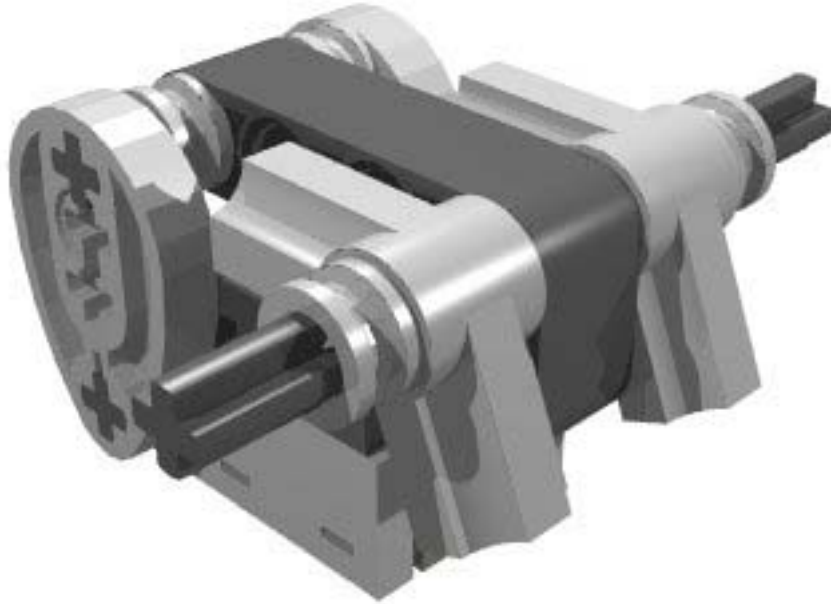
Step 10. Cap the ends of the axles with another cam.



Step 11. Place the Axle 6 through the hole at the bend of the lift arm and place a Connector 5 on each end.



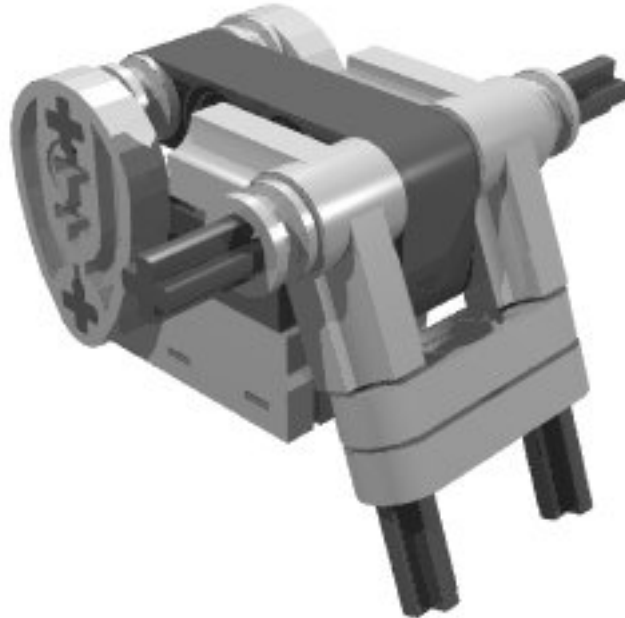
Step 12. Add 2 more 1/2 bushings to keep the Connector 5s in place. Make sure that the connectors can move freely.



Step 13. Then attach Axle 4s to each connector 5.



Step 14. Attach the flat lift arms to the protruding axles. These will form the plunger that will push the touch sensor.



Step 15. All we have left to do is attach the bent lift arms to act like antennae. This way, the robot can sense objects that are not directly in front of it.

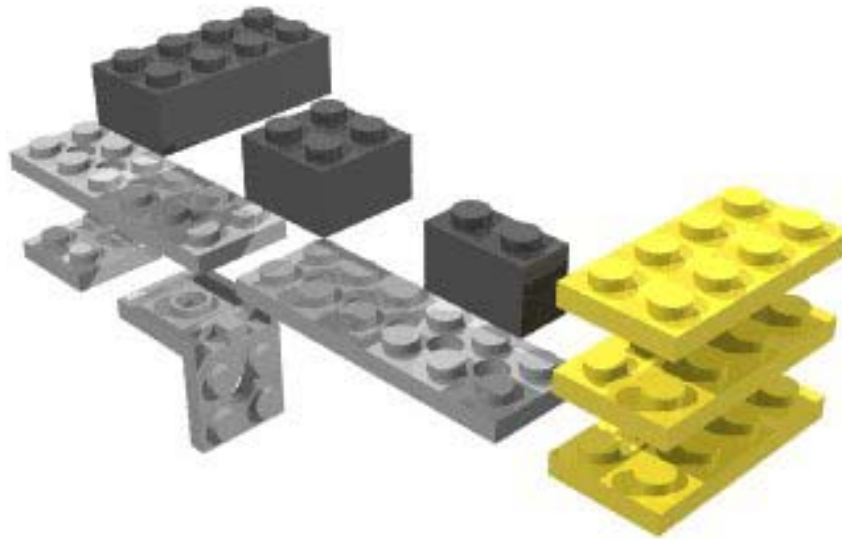


PUTTING IT ALL TOGETHER

Let's finish up Roger.

To finish Roger you'll need the following parts:

Quantity	Color	Item Description
1	Black	Frame
1	Yellow	RCX
2	Gray	2x6 Plate With Holes
2	Black	1x2 Brick
1	Black	2x2 Brick
1	Black	2x4 Brick
3	Yellow	2x4 Plate
1	Gray	90 Degree Bracket
1	Gray	2x2 Plate
1	Blue	Light Sensor
1	Gray	Bumper Assembly



Step 1. First, attach the RCX to the frame. The gray plates on top of the frame should fit exactly into RCX's bottom.



Step 2. Now you should attach your wheels to Roger. You can use any wheels you like, but for this robot we suggest using 49.6x28 VR wheels (they look like racing tires).



Step 3. Attach the 2x6 plate to the bottom of Roger. The plate should stick out 1 row of studs right in the middle of the robot.



Step 4. Put the 1x2 brick on the protruding studs. This will make a sensor extension that is 4 studs long.



Step 5. On top of the extension, attach 2-2x4 plates. These will add strength and raise the light sensor so that it doesn't scrape on the ground.



Step 6. Now attach the 90-degree bracket and the 2x2 plate. This will hold the light sensor.



Step 7. On top of the bracket, place a 2x4 brick and the other 2x6 plate. This little extension will hold the bumper.



Step 8. On top of the plate, place the 2x2 brick and another 1x2 brick.



Step 9. We're almost done. Now it's time to add the sensors. Place the light sensor on the bracket and the bumper on the 2x6 plate.



Step 10. Now, on top of the bumper, place the last 2x4 plate. It should cover the 2x2 and 1x2 bricks and should cover the first row of studs on the bumper. This will help hold the bumper together if it crashes into things.



That's it. We're done with Roger. Test him out and compare your findings with Bobo. You should notice advantages and disadvantages to both designs.



Figure 1 Roger

Applications of Roger

Roger with two light sensors



Roger a fan (Firefighter Roger)



