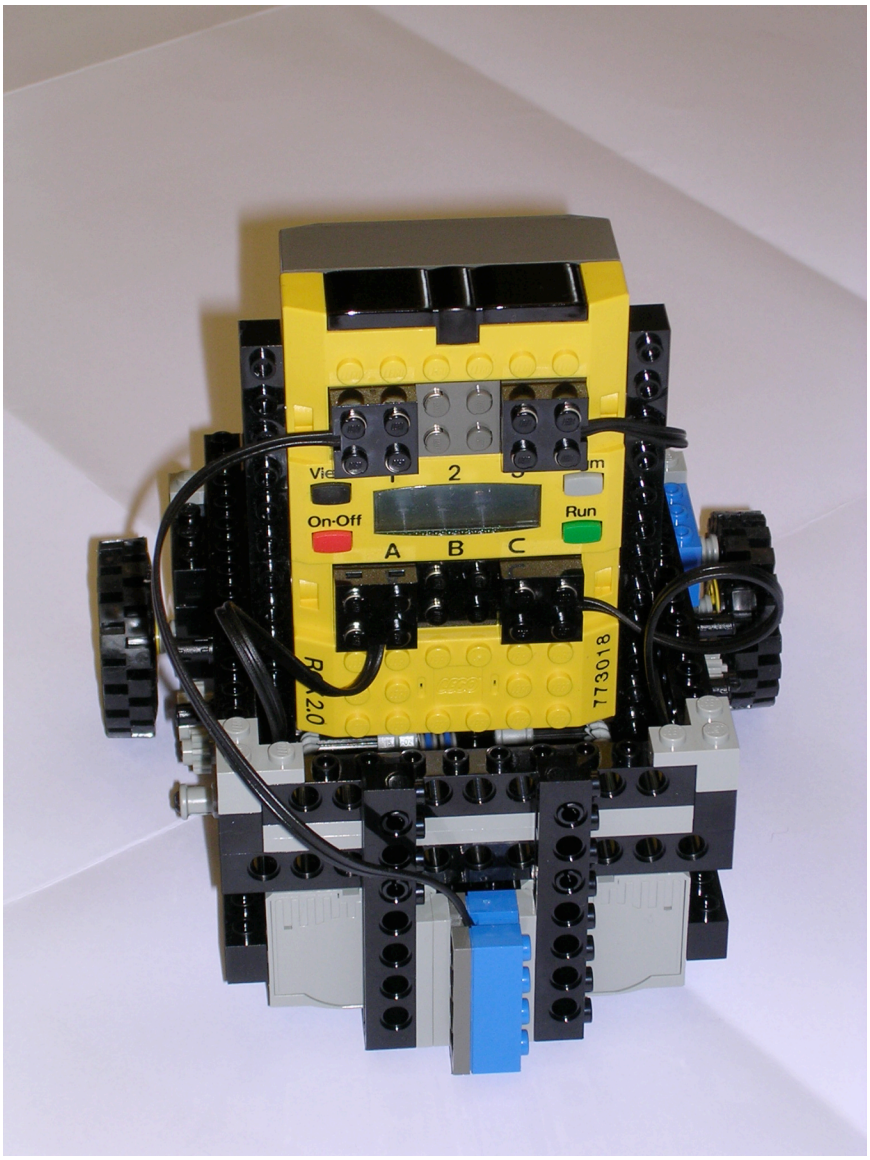
Dual Differential Drive Robot

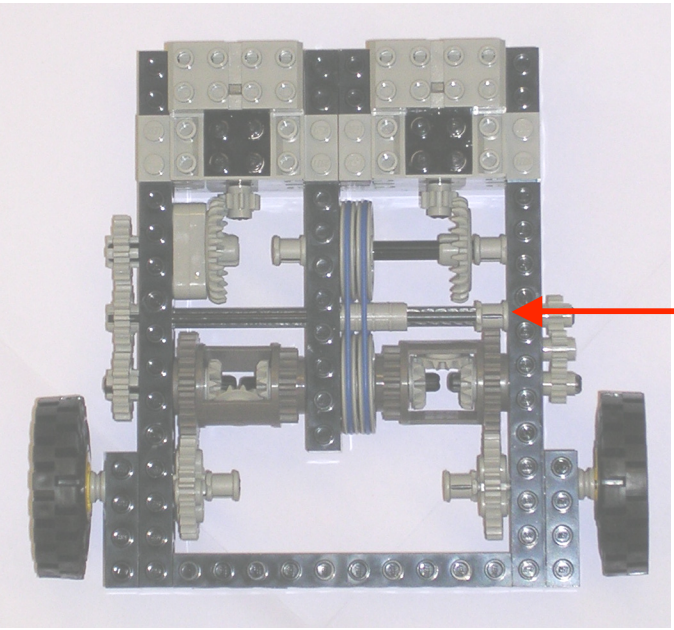


Introduction

The instructions below builds a dual differential drive robot that is adapted from the one that is made in the book *Building Robots with Lego Mindstorms* by Mario and Giulio Ferrari and Ralph Hempel. This model is used because it is by far the most compact version of a dual differential drive platform I have seen.

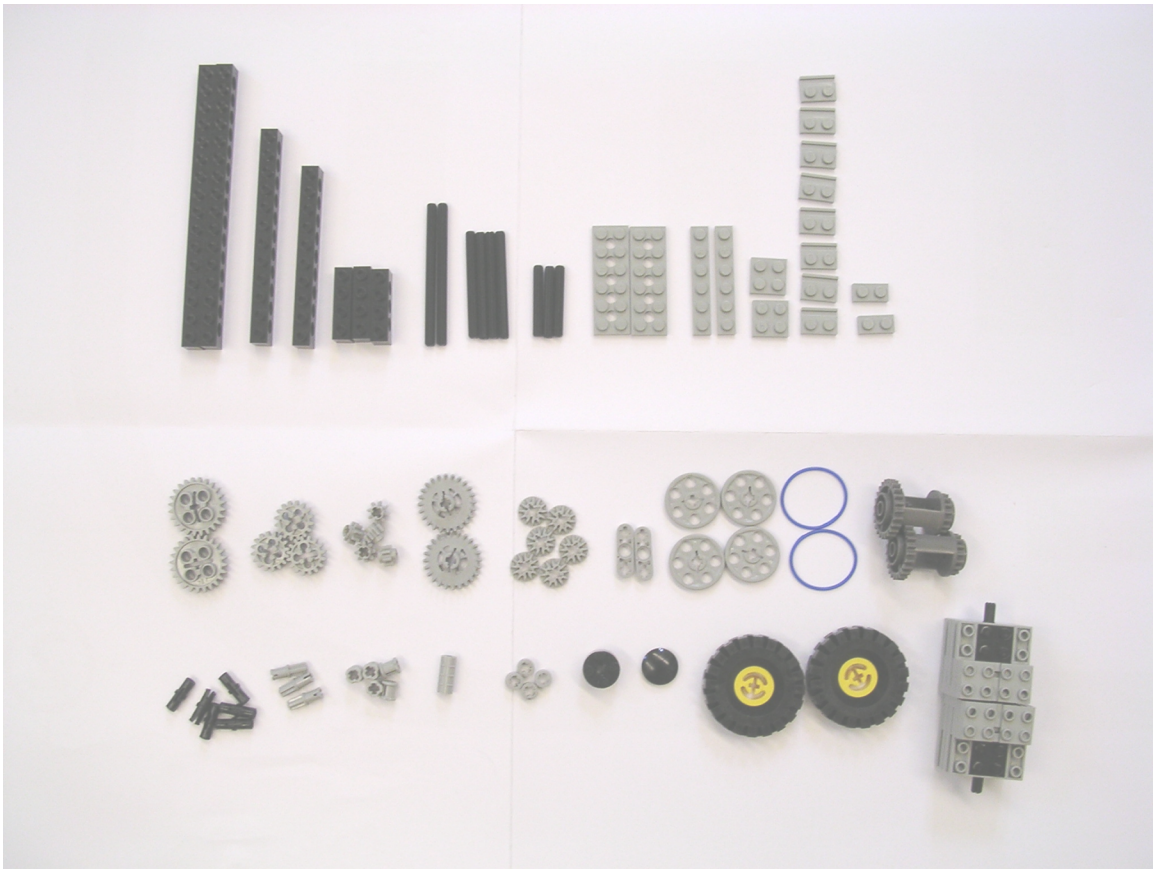
Drive Base

This section provides instructions for creating the most essential part of the robot – the drive base.



NOTE: The red arrow points to a bushing that should NOT be present in the design (it is pictured in this image by mistake). The instructions below will omit this piece.

Step 0: Parts List



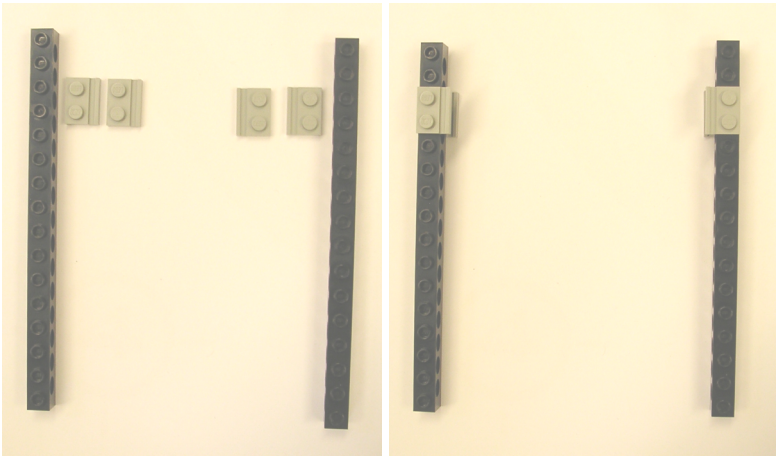
From left to right and then from top to bottom

2	1 x 16 beam
1	1 x 12 beam
1	1 x 10 beam
3	1 x 4 beam
2	8 cross axle
4	6 cross axle
3	4 cross axle
2	2 x 6 plate with holes
2	1 x 6 plate
2	2 x 2 plate
8	1 x 2 plate with rail
2	1 x 2 plate
2	24t gear
3	16t gear
5	8t gear
2	24t crown gear
6	12t bevel gear
2	1 x 3 liftarm
4	medium pulley
2	blue rubber band
2	differential gear box

6 2-stud friction pin
3 TECHNIC axle pin
4 bushing
1 axle joiner
4 half bushing
1 2 x 2 round brick
1 2 x 2 round dish
2 rubber tire (approximately 42 cm diameter) with wheel center
2 geared motor

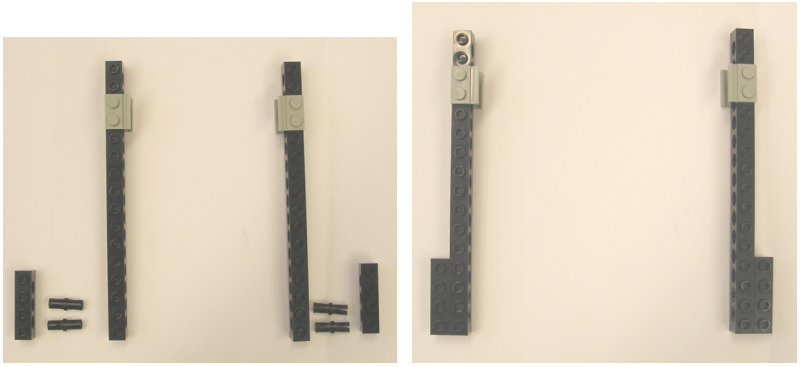
Step 1: 4 1x2 plate with rail, 2 1x16 beam

Attach 2 1x2 plate with rail to peg 3 and 4 of each of the 1x16 beams. There should be one on the top and one on the bottom with rails should face inward.



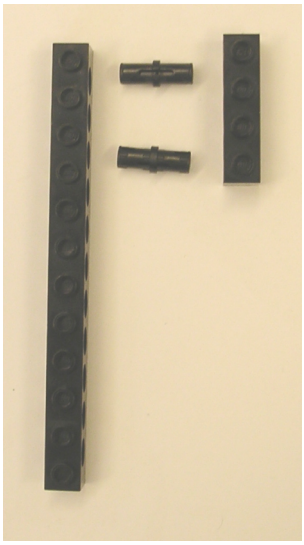
Step 2: Step 1, 2 1x4 beam, 4 2-stud friction pin

Attach friction pins to hole 14 and 15 (bottom 2) of pieces from step 1 facing outward, and then attach the 1x4 beams.



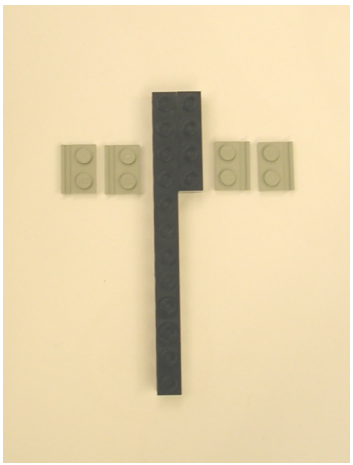
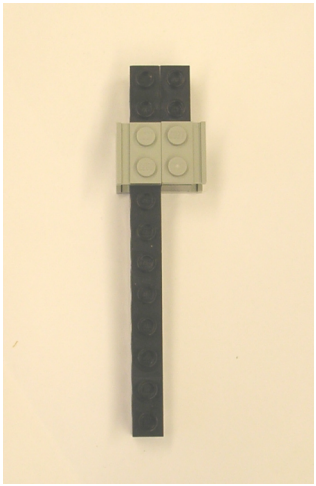
Step 3: 1 1x12 beam, 1 1x4 beam, 2 2-stud friction pin

Attach friction pins on the right of hole 1 and 3 to join a 1x4 beam.



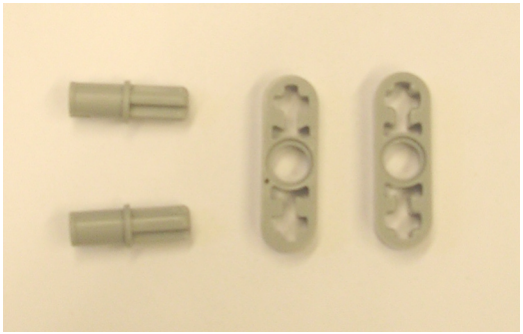

Step 4: Step 3, 4 1x2 plate with rail

Attach the 1x2 plate with rail to peg 3 and 4 of the beams from step 2 on the top and bottom with rail facing outward.

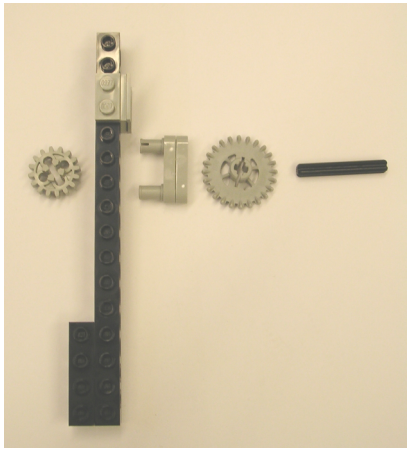
Step 5: 2 TECHNIC axle pin, 2 1 x 3 liftarm

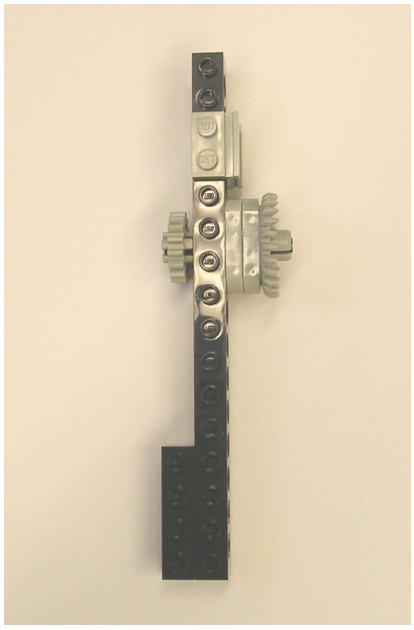
Attach axle pins to both liftarms, one through the other.




Step 6: Left half of Step 2, Step 5, 1 16t gear, 1 24t crown gear, 1 length 4 cross axle

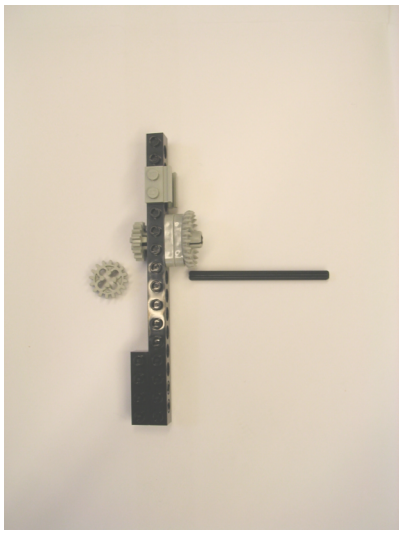
Attach the piece from step 5 to hole 5 and 7 to the right of the left piece from step 2. Then use the length 4 cross axle to join the two gears through hole 6.

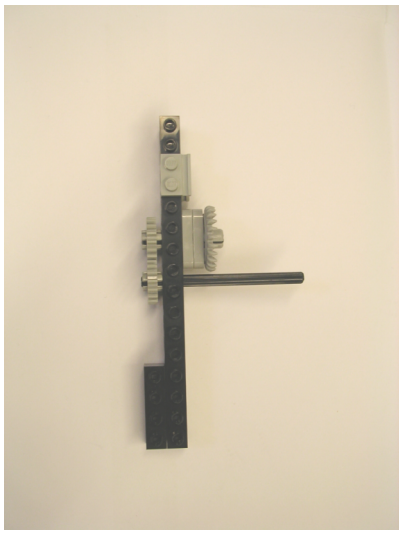




Step 7: Step 6, 1 16t gear, 1 length 8 cross axle

Attach the 16t gear to the left of the piece from step 6 using the length 8 cross axle through hole 8.

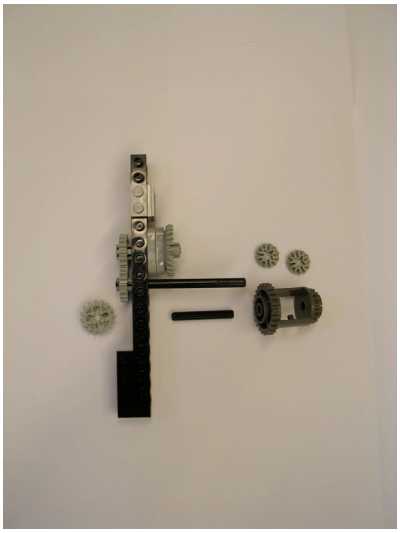
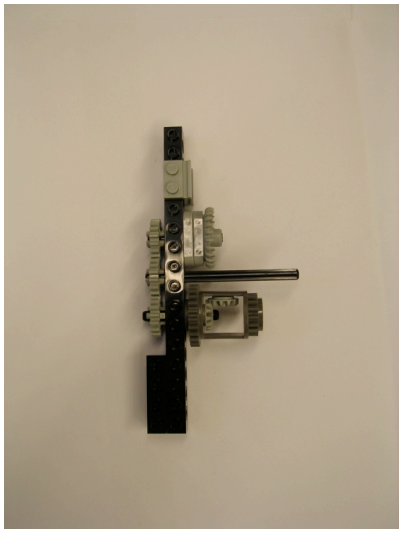




Step 8: Step 7, 1 16t gear, 1 length 4 cross axle, 1 differential gear box, 2 12t bevel gear

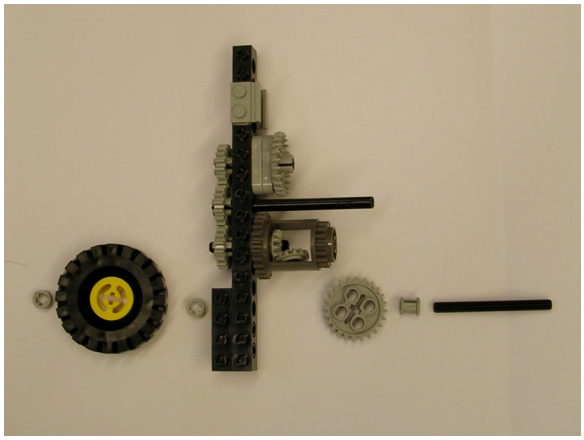
Position one 12t bevel gear on the central peg inside the differential gear box and the another at the left hole. Attach the 16t gear to the left of the piece from step 7 and the differential gear box with gears inside to the right. Do this with the length 4 cross axle through hole 10.

Note: You must put the 12t bevel gear on the central peg first, before placing the 12t bevel gear on the side. Also, make sure the orientation of the differential gear box is correct with the 24t gear part to the left.

Step 9: Step 8, 2 half bushing, 1 tire with center, 24t gear, 1 bushing, length 6 cross axle

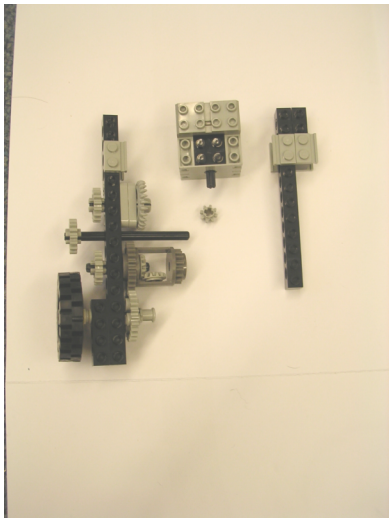
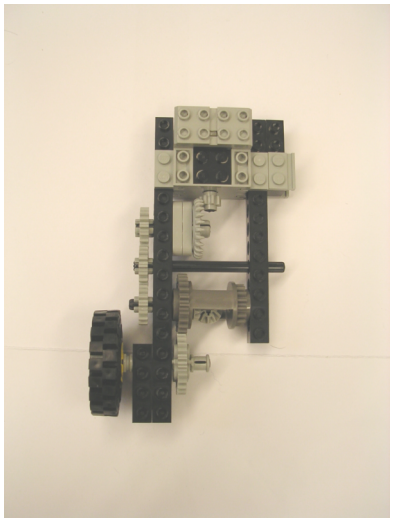
Attach the pieces using length 6 cross axle through hole 13 in the following order from left to right: half bushing, wheel (indentation in the wheel to the left) , half bushing, beams, 24t gear, bushing.




Step 10: Step 9, 1 geared motor, 1 8t gear, Step 4

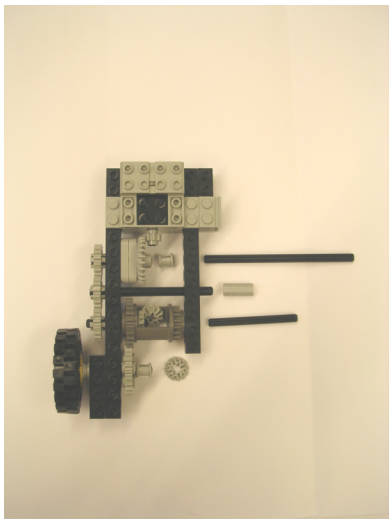
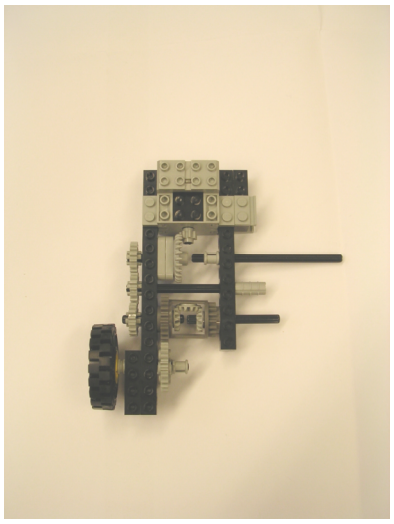
Attach the 8t gear to the cross axle on the motor, and then attach the rails to slots on both sides of the motor.

Note: The long axle with go through hole 8 of the piece from step 4 as well.

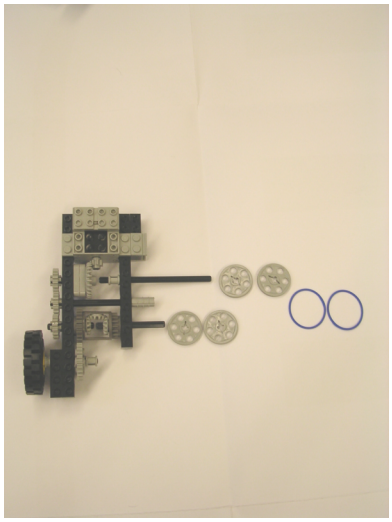
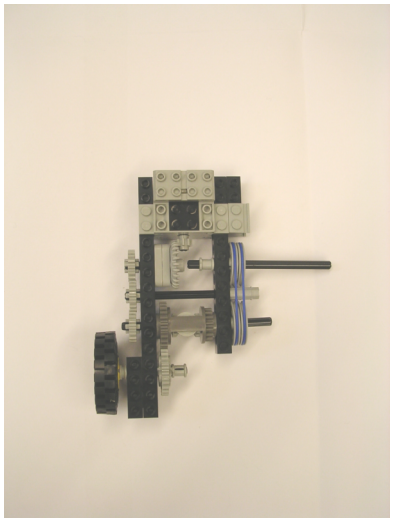
Step 11: Step 10, 1 bushing, 1 axle joiner, 1 length 6 cross axle, 1 length 8 cross axle

Using the right beam as the center, attach the bushing to the left of hole 6 using the length 10 cross axle. Then use the axle joiner to the cross axle through hole 8 on the right. Finally, fit the 12t bevel gear inside the gear box beside the right hole and use the length 6 cross axle to attach the gear through hole 10.

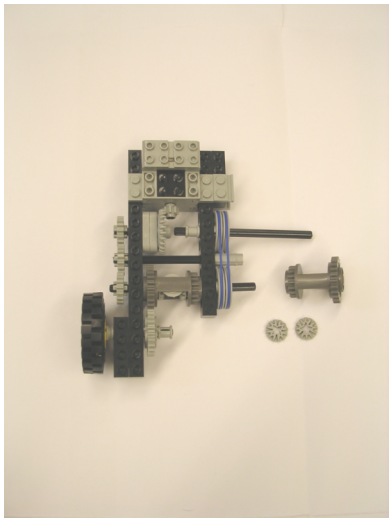
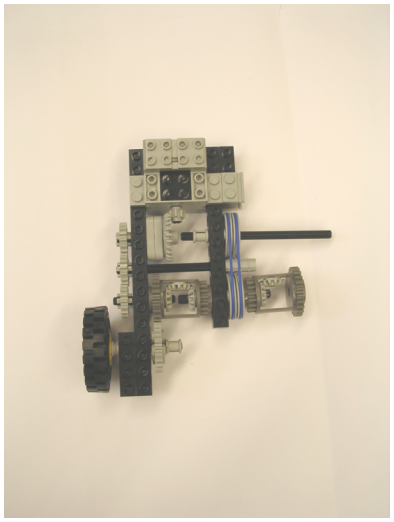
Step 12: Step 11, 4 medium pulley, 2 blue rubber band

Attach two pulleys on each of the cross axles through hole 6 and 10 of the right beam. The pulleys should reside immediately to the right of that beam. Then, attach both blue rubber bands.

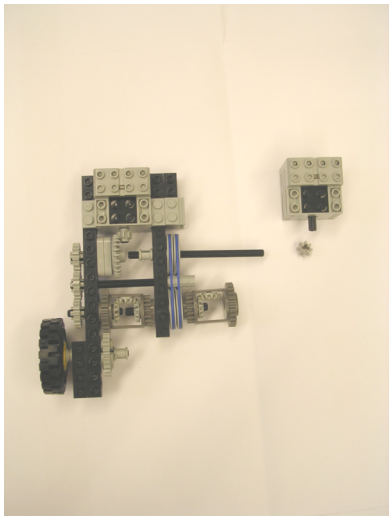
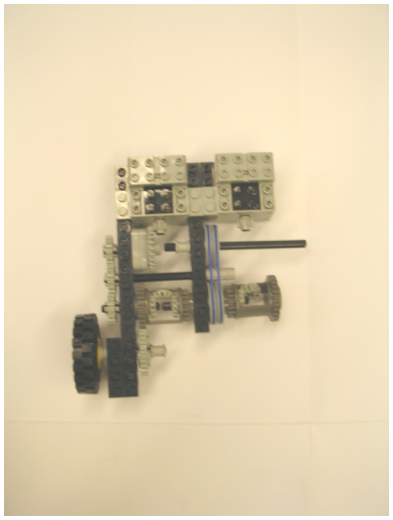
Step 13: Step 12, 1 differential gear box, 2 12t bevel gear

Position the two 12t bevel gears inside the differential gear box and attach the 16t portion to the cross axle through hole 10 of the right beam.

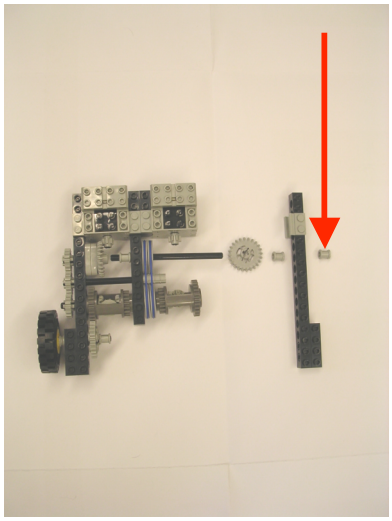
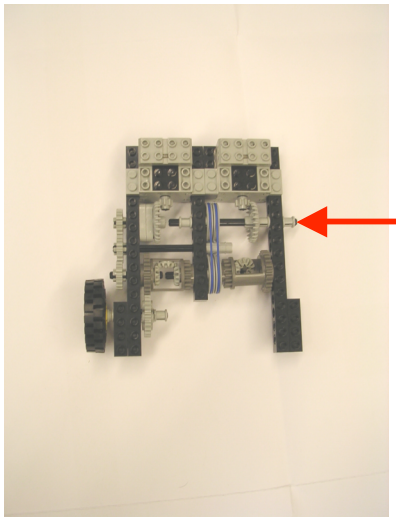
Step 14: Step 13, 1 geared motor, 1 8t gear

Attach the 8t gear onto the motor cross axle and slide the motor into position with the rails to the left.

Step 15: Step 14, right half of Step 2, 1 bushing, 1 24t crown gear

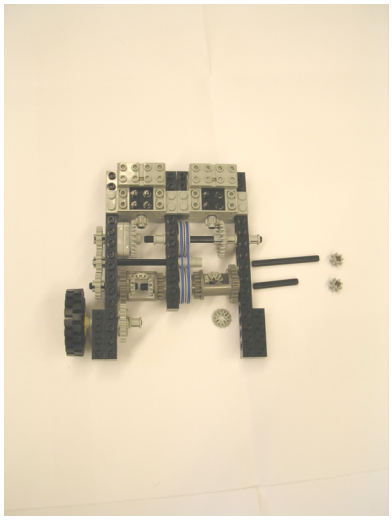
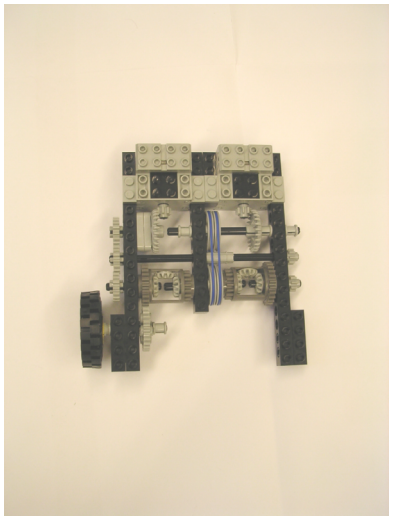
Slide the 24t crown gear on the cross axle to the left until the teeth touch the 8t gear on the motor. Then add a bushing and attach the railing of the new right beam to the motor so that the cross axle goes through hole 6.

NOTE: The red arrows point to a bushing which should *not* be included in the design. Please ignore this bushing in the remaining pictures.

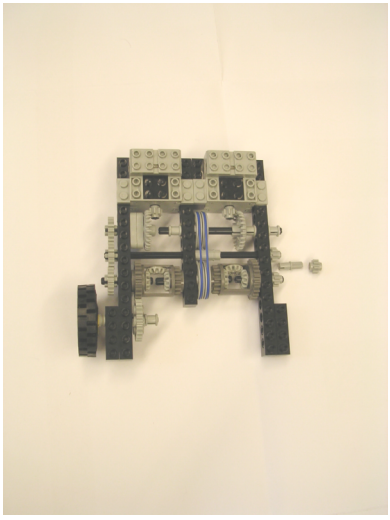
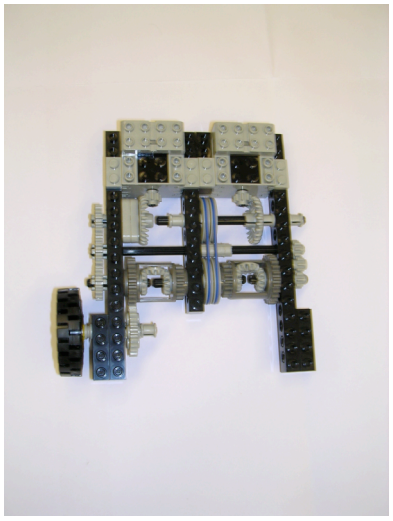
Step 16: Step 15, 1 length 4 cross axle, 1 length 6 cross axle, 1 12t bevel gear, 2 8t gear

Attach the length 6 cross axle to the axle joiner through hole 8 on the right beam. Position the 12t bevel gear inside the gear box and attach that gear with the length 4 cross axle through hole 10. Finally, attach an 8t gear to each of the cross axles just used.

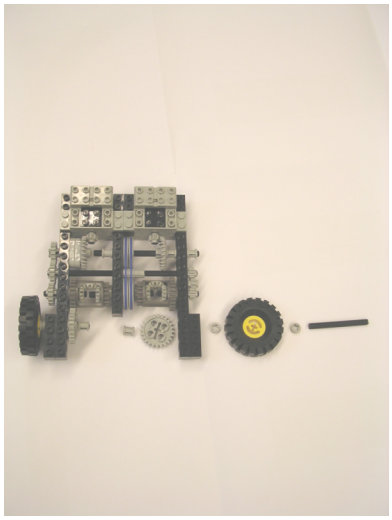
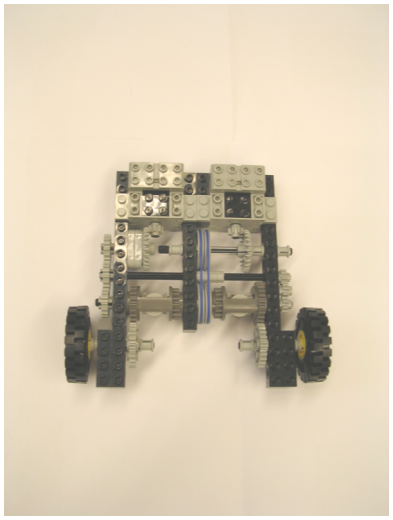
Step 17: Step 16, 1 TECHNIC axle pin, 1 8t gear

Attach the 8t gear to the axle pin and the combination onto the right beam at hole 9.

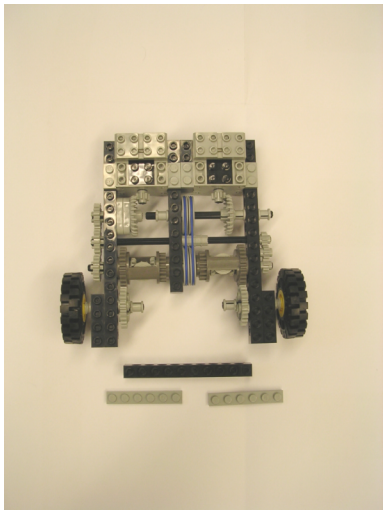
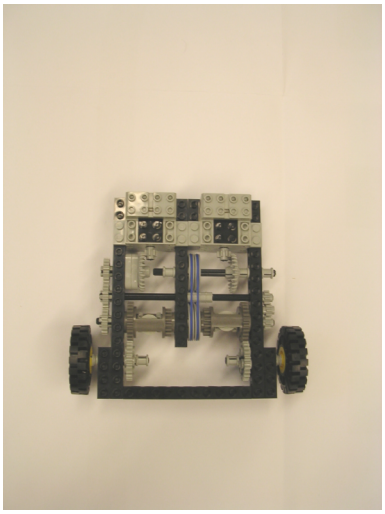
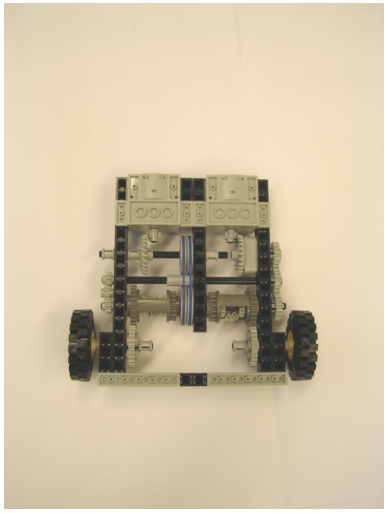
Step 18: Step 17, 1 bushing, 1 24t gear, 2 half bushing, 1 tire with center, 1 length 6 cross axle

Use the length 6 cross axle through hole 13 attaching bushing and 24t gear to the left and half bushing, tire, and half bushing to the right.

Step 19: Step 18, 1 1x10 beam, 2 1x6 plate

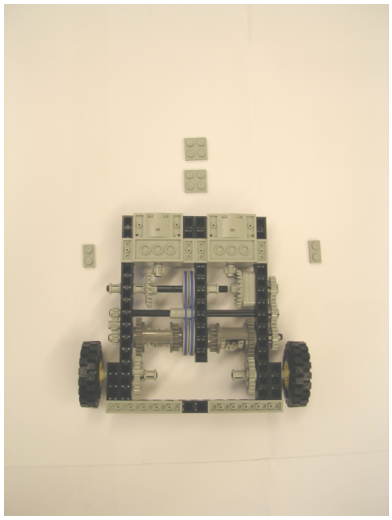
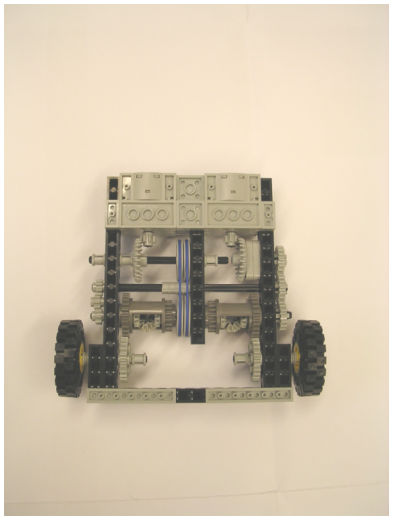
Fit the 1x10 beam between the left and right beams at peg 16, and attach it using the two 1x6 plate at the bottom.

NOTE: The third picture above, as well as all remaining pictures, show the underside of the drivetrain.

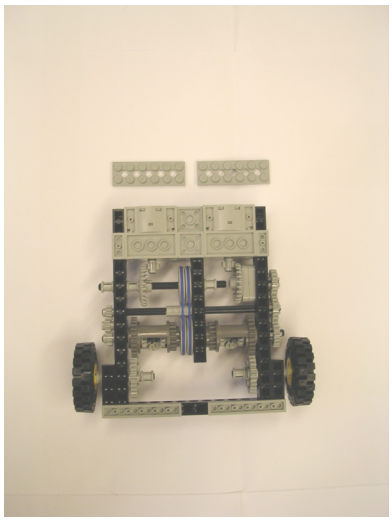
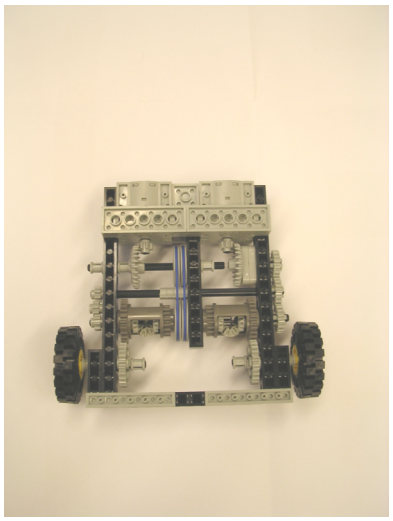
Step 20: Step 19, 2 2x2 plate, 2 1x2 plate

Put one 2x2 plate at the top center, and another one just below that under the two 1x2 plate with rail. Also, place the 2 1x2 plate beneath the 1x2 plate with rail on either side. This should create a smooth surface for the third and fourth rows.

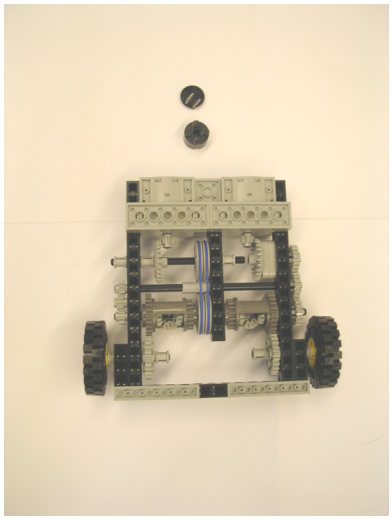
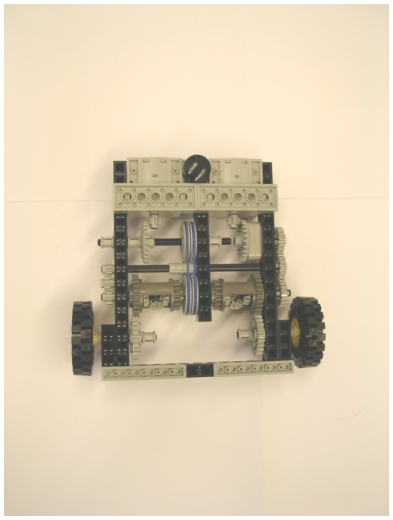
Step 21: Step 20, 2 2x6 plate

Attach the two 2x6 plate to the third and fourth rows.

Step 22: Step 21, 1 2x2 round brick, 1 2x2 round dish

Attach the 2x2 round dish to the bottom of the 2x2 round brick, and place the combination on the top center.

The drive base is complete!