

Rack and Pinion Lab

Theme: Gears

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Purpose

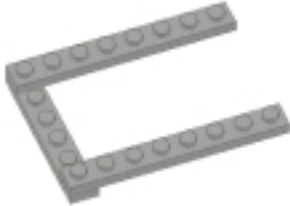

The rack and pinion gear combination is a commonly used system for translating rotational motion to linear motion. One of the most important uses for the rack and pinion system is in a steering system. In this lab you will build a simple rack and pinion steering system to learn the basics of how the system works.


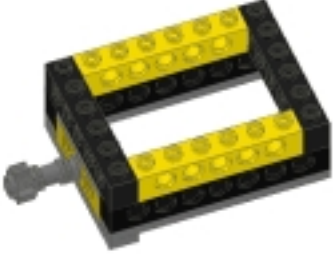
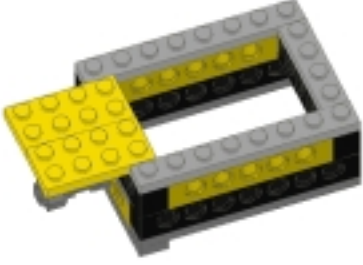
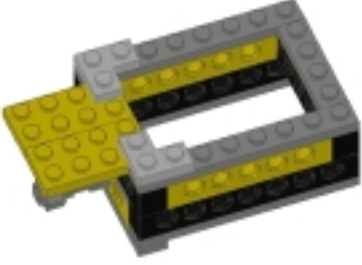
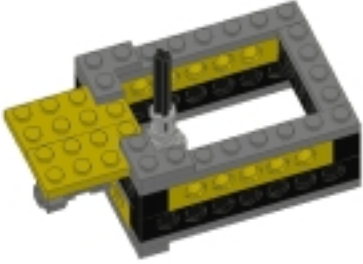
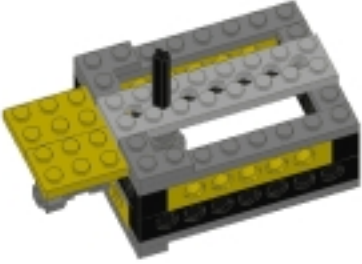
Constructing the Car







Parts:

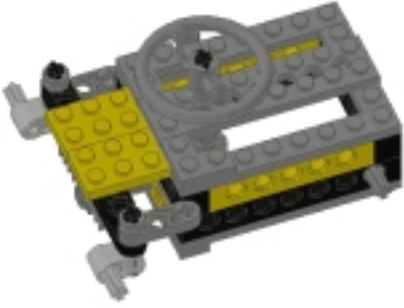



- 2: 1 x 4 Plates
- 1: 1 x 6 Plate
- 4: 1 x 8 Plates
- 2: 2 x 2 Corner Plates
- 2: 2 x 4 Plates
- 2: Technic Axle length 3
- 1: Technic Axle length 4
- 1: Technic Axle length 5
- 4: Perpendicular Technic Axle Joiners
- 8: Technic Axle Pins
- 1: 1 x 4 Technic Brick with Holes
- 4: 1 x 6 Technic Bricks with Holes
- 2: 1 x 8 Technic Bricks with Holes
- 3: Technic Bushes
- 6: Technic Smooth 1/2 Bushes
- 1: Technic 8 Tooth Gear
- 2: Technic 12 Tooth Bevel Gears
- 1: 1 x 4 Technic Gear Rack
- 2: 1 x 3 Technic Lift arms
- 2: 1 x 7 Technic Lift arms
- 2: Technic 1/2 Pins
- 1: 2 x 8 Technic Plate with Holes
- 1: Large Technic Pulley
- 4: Wheels

Instructions:

<p>1</p> 	<p>2</p> 
<p>Attach two 1 x 8 plates to a 1 x 6 plate as shown.</p>	<p>Place on each of the 1 x 8 plates a 1 x 8 brick with holes. Attach a 1 x 4 brick with holes as shown.</p>

<p>3</p> 	<p>Snap onto that a 1 x 4 plate.</p> <p>4</p> 
<p>Slide a length four axle into the center of the indicated brick. Attach onto one side the 12 tooth bevel gear. On the other place a smooth 1/2 bush then a full bush and finally an 8 tooth gear.</p>	<p>Place on the top of the frame the four 1 x 6 bricks with holes as shown in diagram.</p>
<p>5</p> 	<p>6</p> 
<p>Place two 1 x 8 plates on either side of the frame. On the side opposite the gears add a 1 x 4 plate. Add two 2 x 4 plates on the other side as shown.</p>	<p>Secure the pieces in place in the corners with two 2 x 2 corner plates.</p>
<p>7</p> 	<p>8</p> 
<p>Place a 12 tooth bevel gear, smooth 1/2 bush and full bush onto a length 5 axle place it as shown, meshing with the other bevel gear.</p>	<p>Slide a 2 x 8 Technic plate with holes over the end of the axle. Place it as indicated.</p>

<p>9</p> 	<p>10</p> 
<p>Attach to the axle a bush and then a large pulley.</p>	<p>Attach on the back a Technic axle pin on both sides.</p>
<p>11</p> 	<p>12</p> 
<p>Place two 1 x 7 lift arms so that they overlap over 6 units in the middle. Attach them with 2 Technic 1/2 pins placed in the center so that a 1 x 4 gear rack could be attached facing downwards.</p>	<p>Attach to the pins placed in the previous step a 1 x 4 Technic gear rack.</p>
<p>13</p> 	<p>14</p> 
<p>Place a 1 x 3 Technic lift arm in each indentation on the ends of the 1 x 7 lift arm system as shown.</p>	<p>Secure these in place with two length 3 axles and two smooth 1/2 bush.</p>

<p>15</p> 	<p>16</p> 
<p>Attach an axle joiner to each axle facing as indicated. Snap into each of those a Technic axle pin facing out.</p>	<p>Attach a Technic axle pin to both parts of of an axle joiner. Attach to the axle side a smooth ½ bush. Slide the remaining section of the axle through the 1 x 3 lift arm, and snap the other into the side of the frame. Repeat the process on the other side except add the bushing after the lift arm is attached.</p>
<p>17</p> 	<p>18</p> 
<p>Attach a wheel hub to each of the four protruding Technic axle pins.</p>	<p>Attach large tires to each of the wheel hubs to complete the steering mechanism.</p>

Lab

1. Push the car around several corners. Turn the large gear on the top to turn the wheels. Continue until you are familiar with the device's behavior.

Questions

1. How could this type of steering be useful in the construction of a robot? In what situations would it perform better or worse than a differential drive?
2. How could this device be improved so the main frame of the vehicle does not move when the steering wheel is turned?
3. How much space does this robot need to turn in? How about turning corners?