MASTER BUILDERS AERIAL TRAM

THE LEGO MASTER BUILDERS

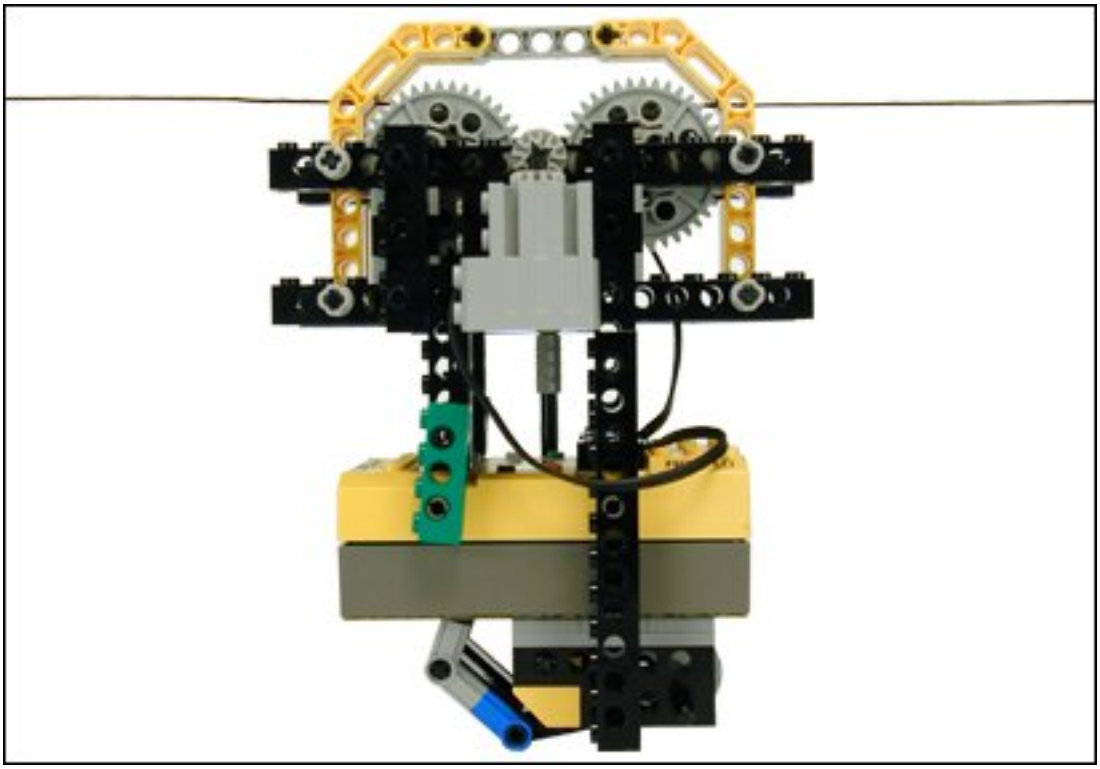
Master Builder: Anthony

Here is an invention that LEGO MINDSTORMS' newest Master Builder has created just for you. Many of you might be familiar with Anthony's work from the Hall of Fame. Now we bring you a step-by-step instruction on how to build another of Anthony's great designs.

The newest mission highlights and explains what an aerial tram is capable of and the different functions it can serve. Now this is your chance to see how one of LEGO MINDSTORMS' own master builders might do it.

Making an aerial tram

Here's how to make a tram that can move across a string:



PART 1: Body Assembly 1

STEP 1

For this step, you will need:

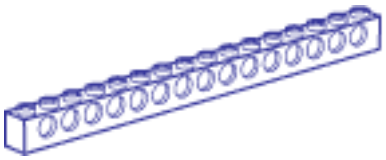
four 1x2 Plates

one 1x2 Brick with Hole

First add two 1x2 plates to the top of the 1x2 brick with hole. Then add the other two 1x2 plates to the bottom of this assembly.

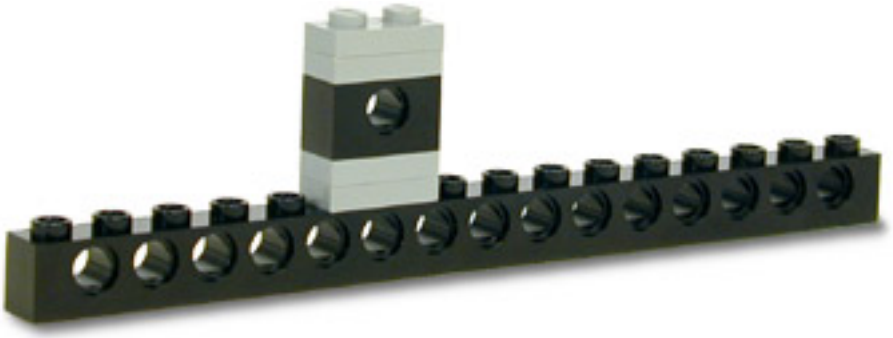
STEP 2

For this step, you will need:



one 1x16 Beam

Add the previous assembly to the 6th and 7th studs of a 1x 16 beam.



STEP 3

For this step, you will need:

 four 1x2 Plates

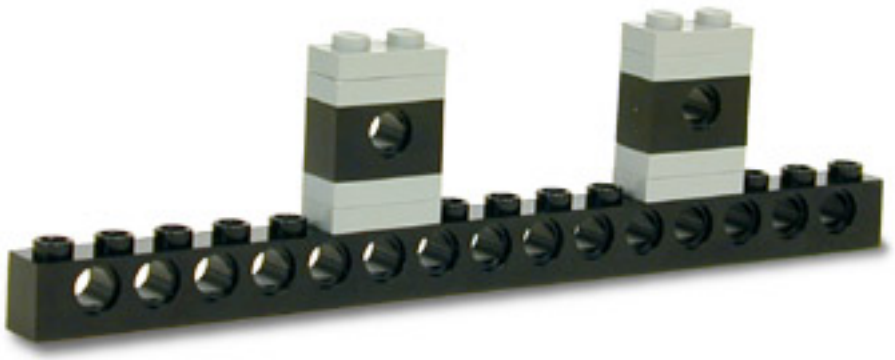
 one 1x2 Brick with Hole

Repeat Step 1 by adding two 1x2 plates to the top of the 1x2 brick with hole. Then add the other two 1x2 plates to the bottom of this assembly.

STEP 4

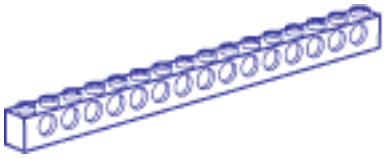
For this step, you will need:

Add this assembly to the 12th and 13th studs of the 1x16 beam assembly.



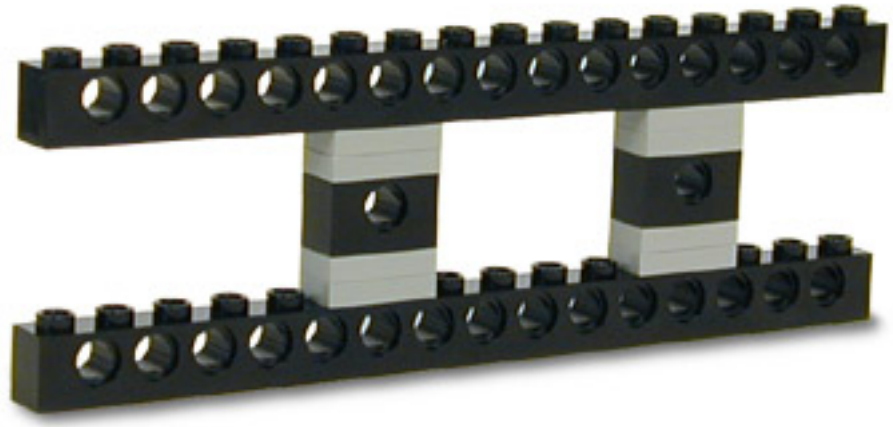
STEP 5

For this step, you will need:



one 1x16 Beam

Place a 1x16 beam on the top of your assembly so that the 2 beams are balanced over each other.



STEP 6

For this step, you will need:

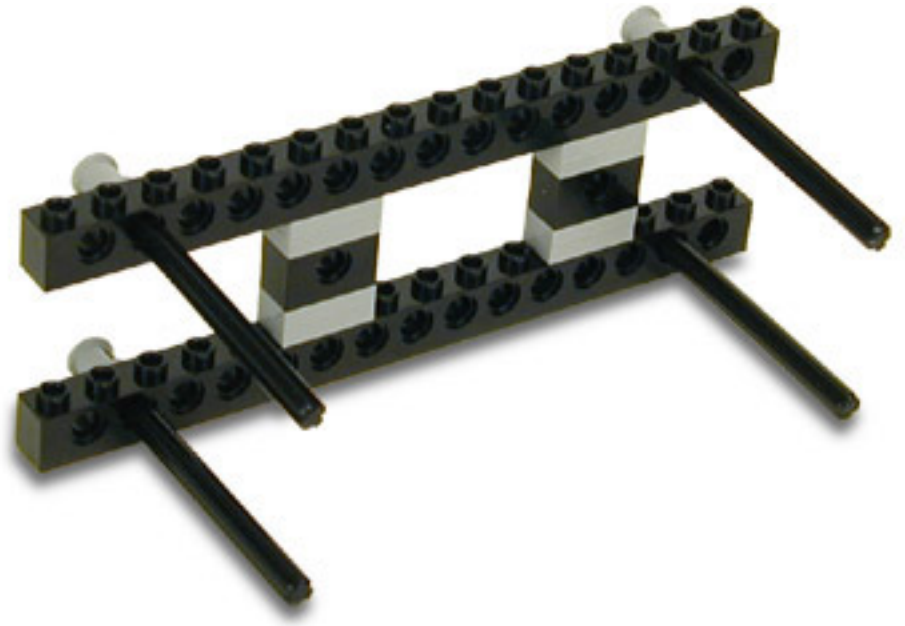
four Bushing for Cross Axle

four 8M Cross Axle

Add 1 bushing to the end of each 8M cross axle. Page 37 of your Robotics Invention System 1.0 Constructopedia will help you measure axle length. You should have 4 examples of this:

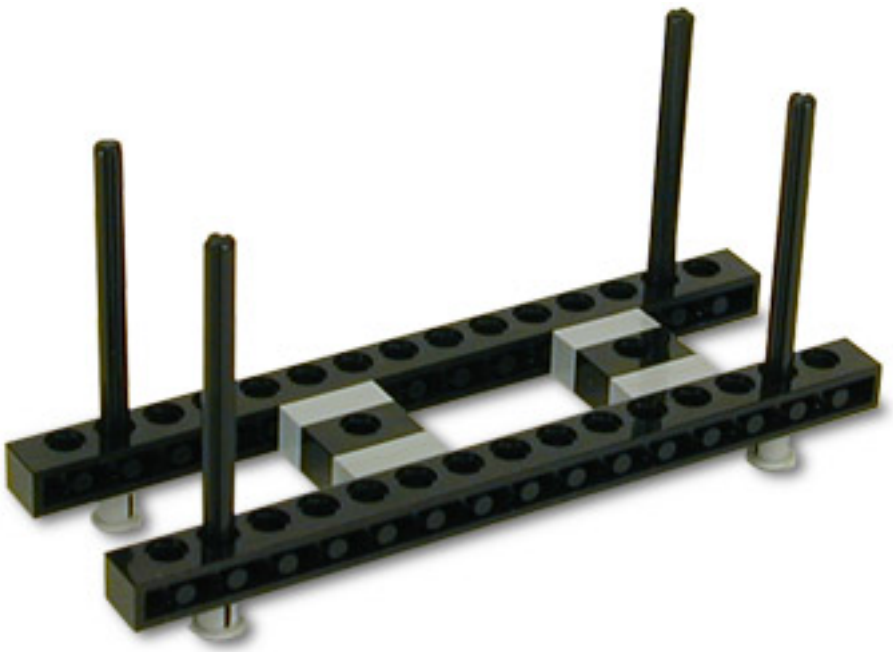
STEP 7

Now push one 8M cross axle with bushing through the back of the 2nd and 14th holes of each 1/16 beam. Make sure the bushings are all on the same side. (Back side)



STEP 8

To make the next several steps easier, position your construction with the axles sticking straight up.

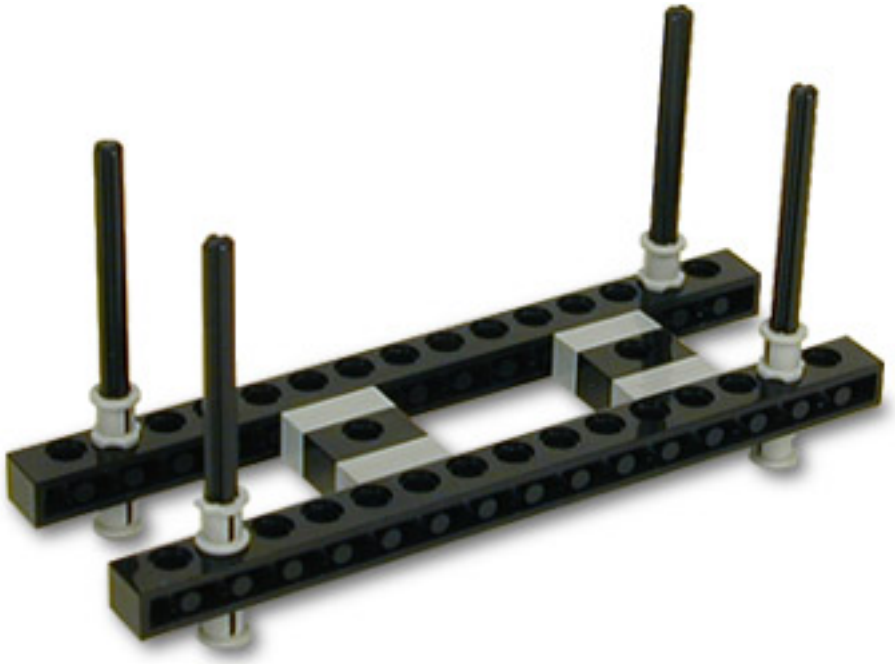


STEP 9

For this step, you will need:

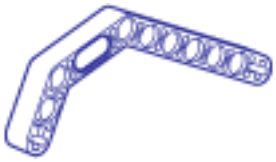
 four Bushings for Cross Axle

Add a bushing to each cross axle. Make sure to push the bushings firmly down towards the beam.

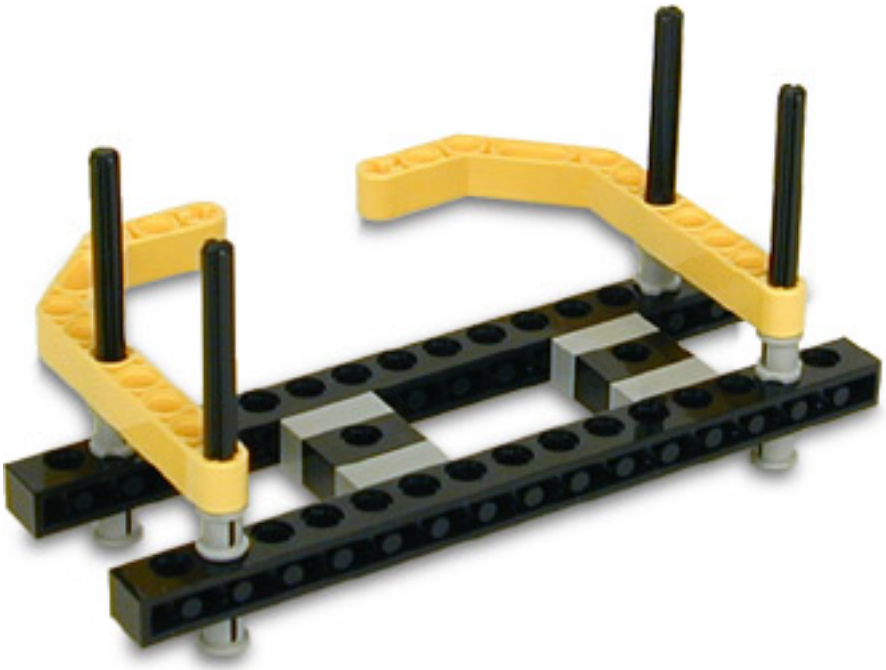


STEP 10

For this step, you will need:

 two Double Angular Beam 3x7

Add 1 double angular beam to each pair of axles, making sure that the double angular beams point inwards toward each other. The bottom axle should fit in the first axle hole of each double angular beam.

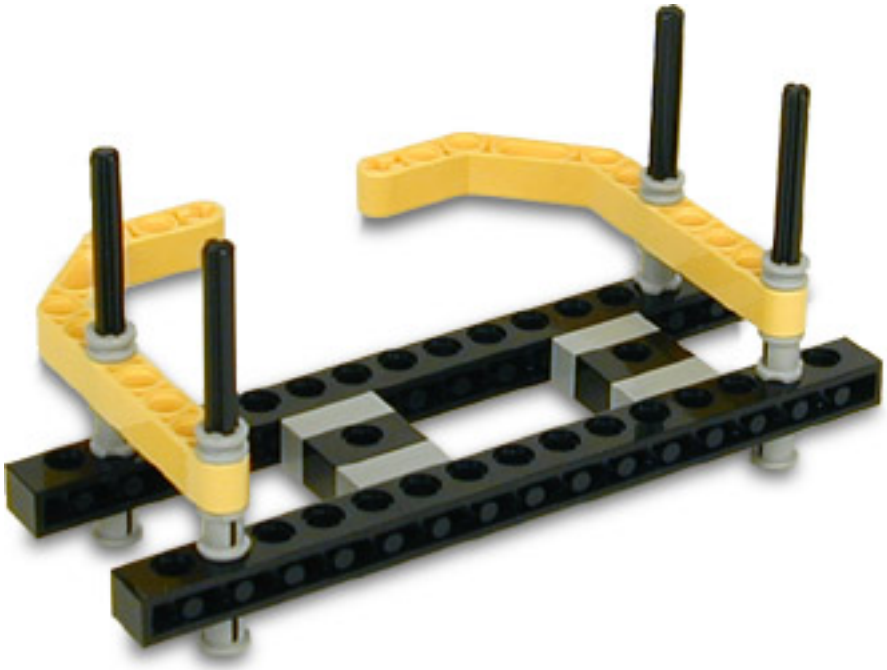


STEP 11

For this step, you will need:

- four 1/2 Bushings

Add a 1/2 bushing to each cross axle, pushing the 1/2 bushing down till it touches the double angular beam.



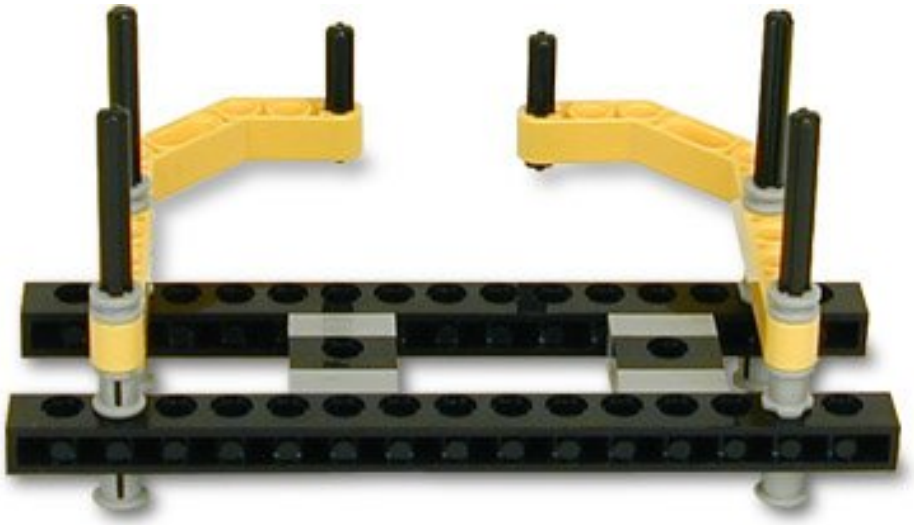
PART 2: Body Assembly 2

STEP 12

For this step, you will need:

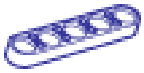
two 3M Cross Axles

Add a 3M cross axle to the top axle hole of each double angular beam. Page 37 of your Robotics Invention System 1.0 Constructopedia will help you measure axle length.



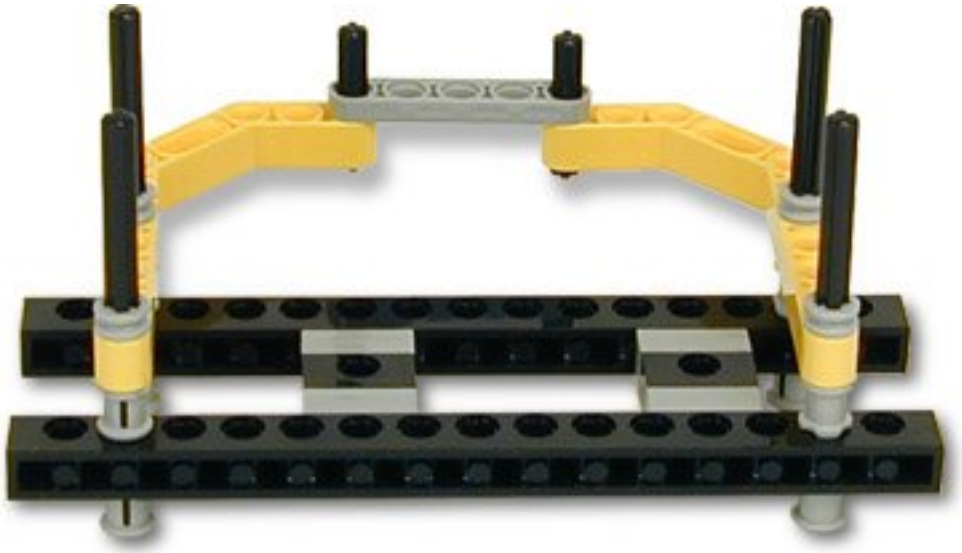
STEP 13

For this step, you will need:



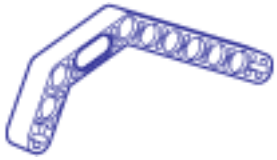
one 5M Half Beam

Connect the two 3M cross axles with the 5M half beam.



STEP 14

For this step, you will need:



two Double Angular Beams

Repeat Step 12 by adding two more double angular beams to your construction. They should exactly match the double angular beams already placed on your assembly.

STEP 15

For this step, you will need:

four 1/2 Bushings

Once again, add a 1/2 bushing to each of the 4 main cross axles, pushing the 1/2 bushings down until they touch the double angular beams.

Set the assembly aside for now.

STEP 16

For this step, you will need:

two 6M Cross Axles

two 40-Tooth Gear Wheel

Push 1 cross axle through the center of each gear wheel. Leave enough room on the short end of each cross axle to fit just through a beam's hole.

Make two of these.

STEP 17

For this step, you will need:

two Bushings

Add a bushing to the long side of each cross axle. Do this for each axle assembly.

STEP 18

For this step, you will need:

two 1/2 Bushings

Add a 1/2 bushing next to each bushing. Do this for each axle assembly.

STEP 19

For this step, you will need:

two White Rims

two 30. 4x14 Tires

Add a tire with rim to each cross axle. Have the front of the tire's rim facing the gear. Note: You will not be able to easily see the bushings between the gear and the tire. Do this for each axle assembly.

STEP 20

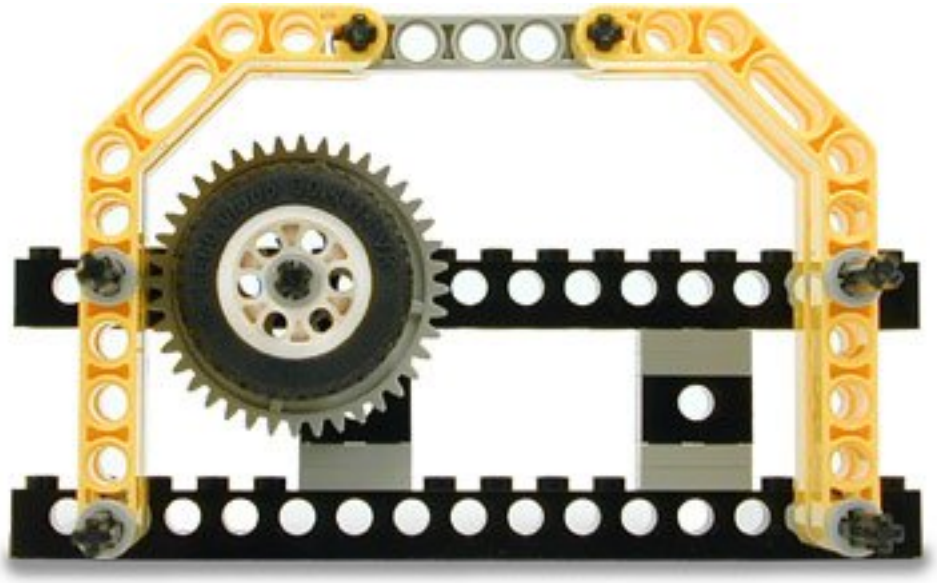
For this step, you will need:

two 1/2 Bushing

Secure the tire on the cross axle by adding a 1/2 bushing to the axle. Do this for each axle assembly.

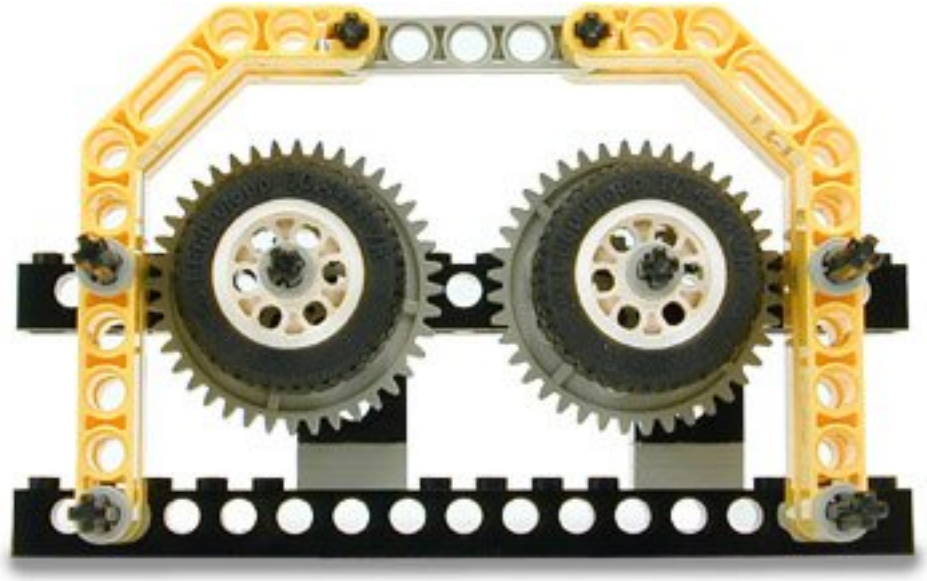
STEP 21

Now we will add these assemblies to the larger construction we worked on in Step 15. Place the first axle assembly in the 5th hole of the top beam with the 40-Tooth Gear Wheel facing downwards, touching the beam. Remember you are adding to the top beam.



STEP 22

Add the second axle assembly to the 11th hole of the top beam. Does your assembly look like this?



PART 3: Body Assembly 3

STEP 23

For this step, you will need:

one 8M Cross Axle

one 8-Tooth Gear

Place the 8-Tooth gear about 2/3rds of the way over on the 8M cross axle.

STEP 24

For this step, you will need:

one 1/2 Bushing

Add a 1/2 bushing next to the 8-Tooth gear.

STEP 25

For this step, you will need:

two Wedgebelt Wheel

Place the 2 Wedgebelt Wheels on the axle facing each other.

STEP 26

For this step, you will need:

one 1/2 Bushing

Place the 1/2 bushing next to the last Wedgebelt wheel to hold it in place.

STEP 27

Place this assembly into the 9th hole of the top beam with the 8-tooth gear touching the beam.

Note: The 8-tooth gear will fit directly between the two larger 40-tooth gear wheels.

STEP 28

Turn your construction over.

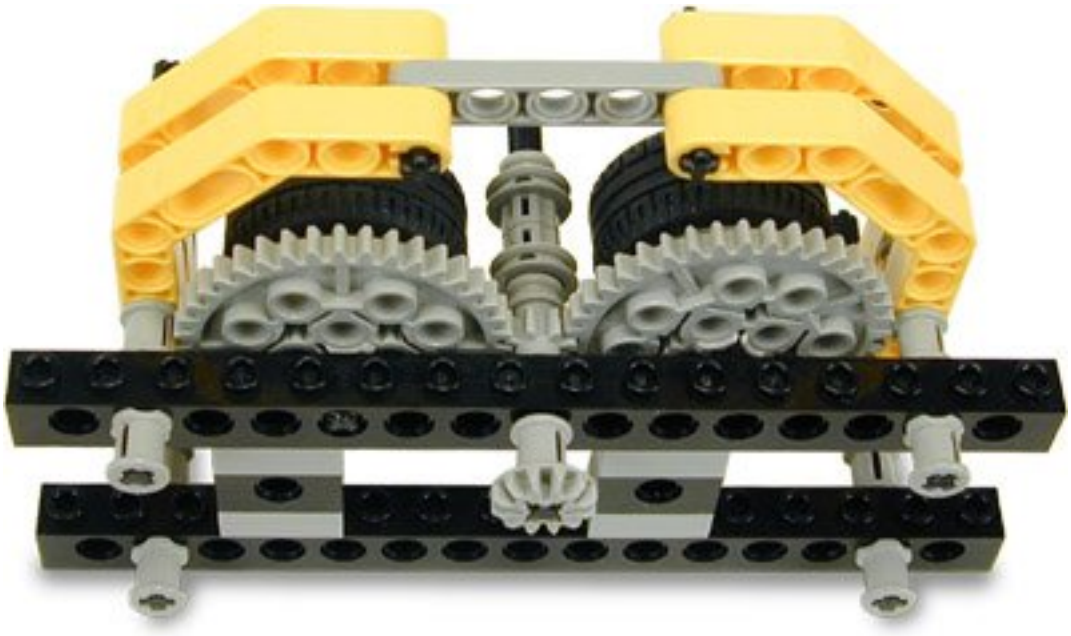
STEP 29

For this step, you will need:

one Bushing

one Bevel Wheel

Add a bushing to the center axle. Then place the bevel wheel next to the bushing with its teeth facing outward.



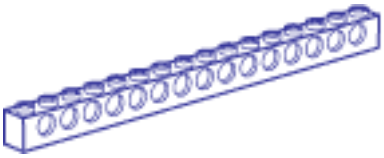
STEP 30

Turn your construction back over.

This is a good point to wind the string around your wheels and gears. Click here to find out more about winding a string on to your constructions.

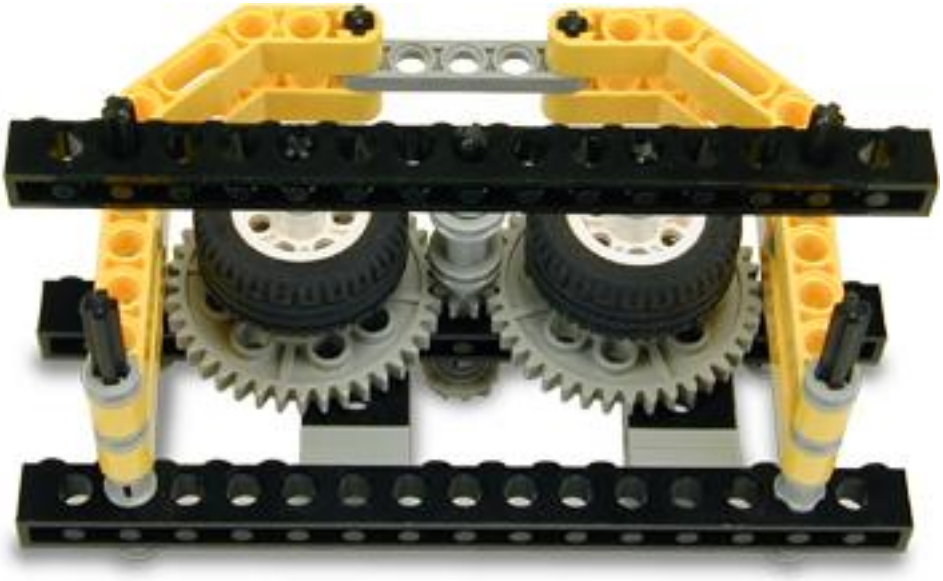
STEP 31

For this step, you will need:



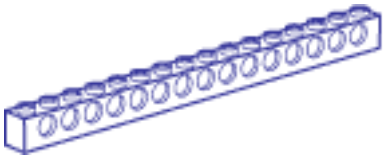
one 1x16 Beam

Fit the 1x16 beam over the top 5 cross axles. The 1x16 beam should be even with its lower twin beam.



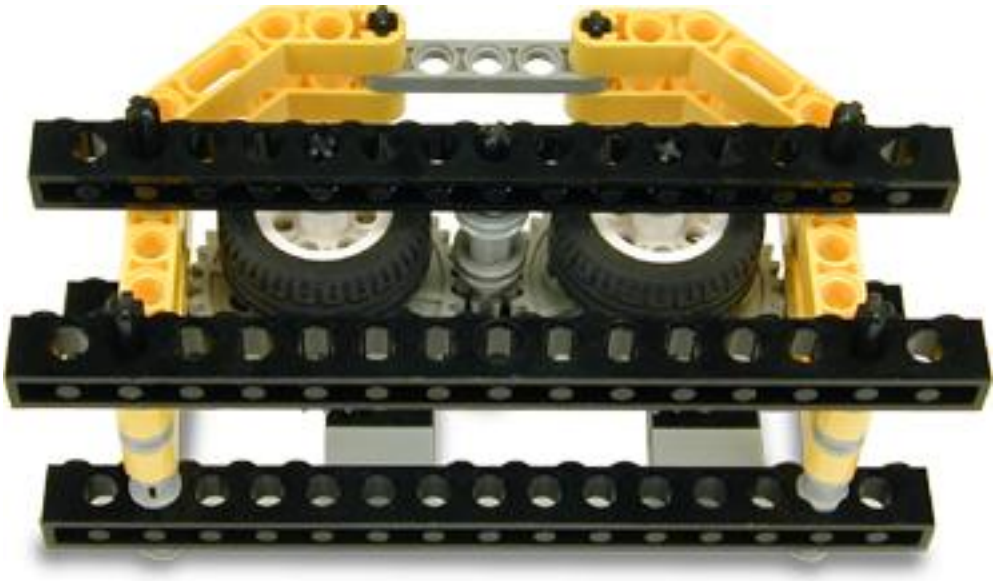
STEP 32

For this step, you will need:



one 1x16 Beam

Fit this 1x16 beam over the bottom 2 cross axles.

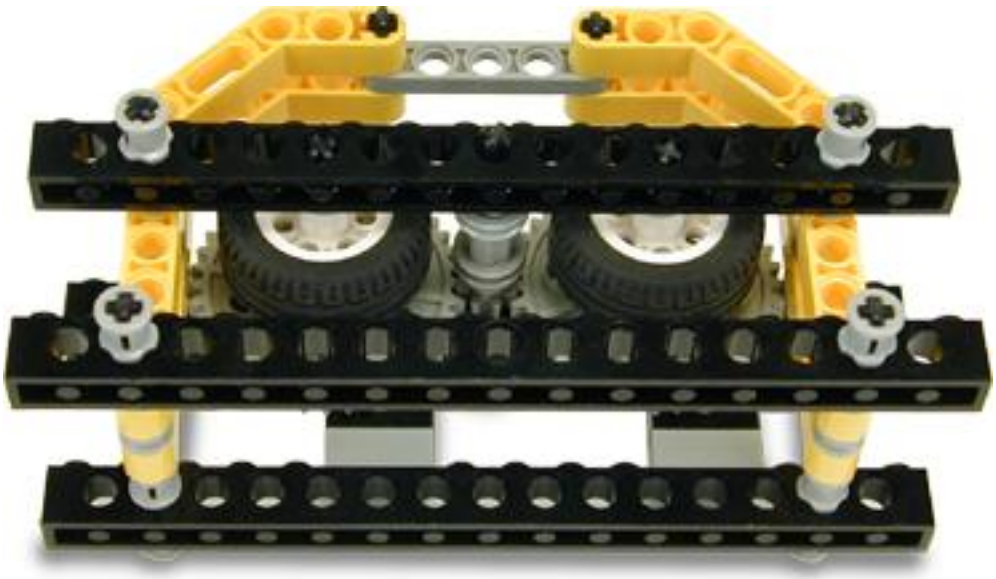


STEP 33

For this step, you will need:

four Bushings

Lock the beams by placing bushings on each of the 4 corner cross axles.



PART 4: Motor Assembly 1

STEP 34

For this step, you will need:

one Bevel Wheel

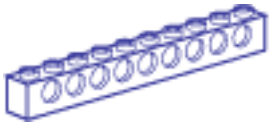
one Motor

Add the bevel wheel to the motor (with the wheel's teeth pointing outward).

STEP 35

For this step, you will need:

two 3M Connector Peg with Friction



one 1x10 Beam

Place a 3M connector peg with friction into holes 1 and 5 of the 1x10 beam.

STEP 35A

Push the 3M connector pegs with friction all the way through the holes of the 1x10 beam.

STEP 36

For this step, you will need:

 one Connector Peg with Friction

From the front of the 1x10 beam, insert the connector peg with friction into hole 3.

STEP 37

Place the motor assembly on studs 3 through 6 of the 1x10 beam. The motor's bevel wheel should point towards stud 1.

STEP 38

For this step, you will need:

two 3M Connector Peg with Friction

one 1x6 Beam

Place a 3M connector peg with friction into holes 1 and 5 of the 1x6 beam.

STEP 38A

Push the 3M connector pegs with friction all the way through the holes of the 1x6 beam.

STEP 39

For this step, you will need:

 one Connector Peg with Friction

From the front of the 1x6 beam, insert the connector peg with friction into hole 3.

STEP 40

For this step, you will need:

 one 1x6 Beam

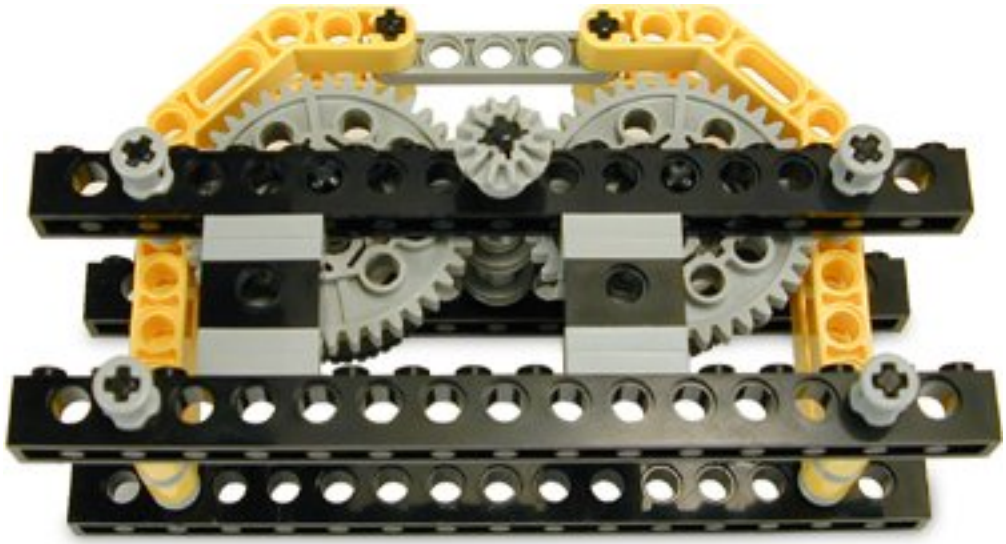
Add a 1x6 beam to the 1x6 beam assembly you just created, by placing your assembly over the 1st and 2nd studs of the new 1x6 beam.

STEP 41

Place this assembly on top of the motor assembly you created in Step 37.

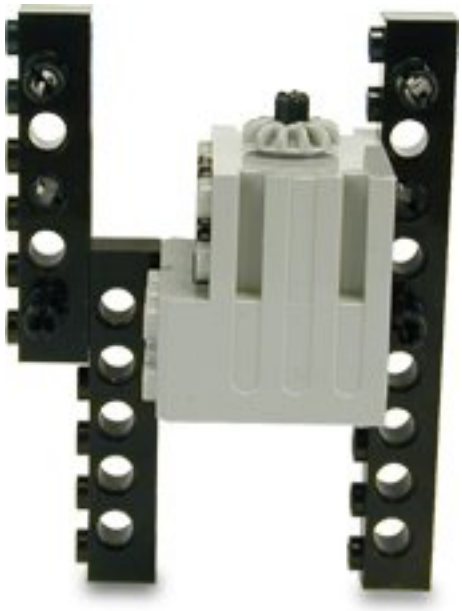
STEP 42

Position the large assemble that you created in Step 33 so that the bevel wheel points up.



STEP 43

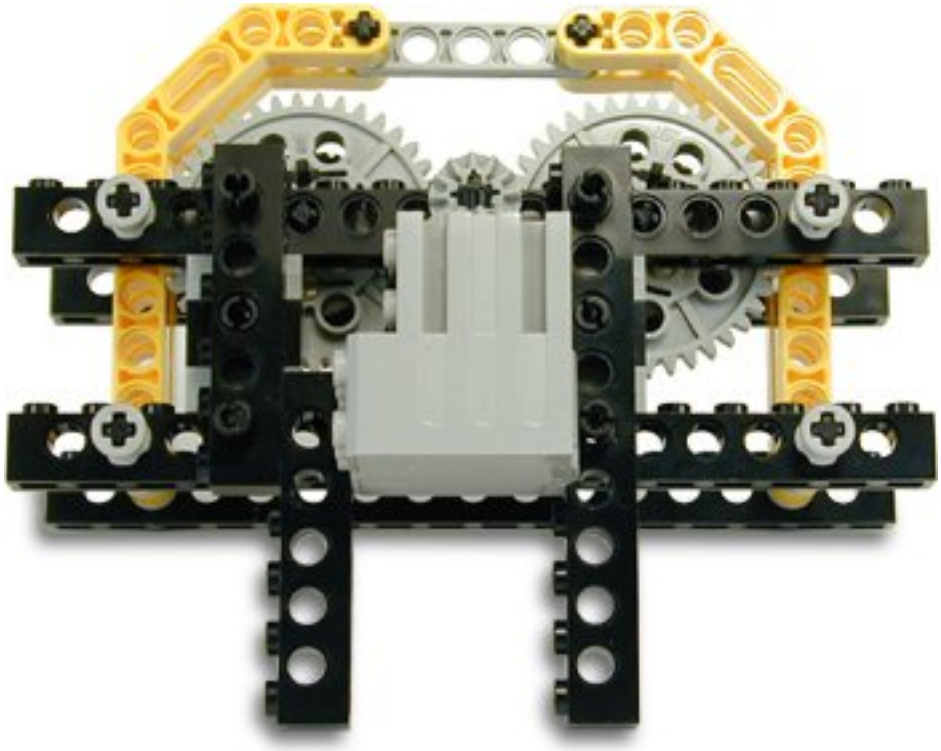
Position your motor assembly from Step 41 so that its bevel wheel points away from you and its six connector pegs point towards your construction.



STEP 44

Attaching the motor assembly is a little tricky. Take your time!

Lock the left side of the motor assembly to your construction starting at the 4th hole of the 1x16 beams. The right side of your motor assembly should be connected to the 10th hole of the 1x16 beams of your construction.



PART 5: Motor Assembly 2

STEP 45

This next assembly can be used to control a grabber arm or a basket door.

For this step, you will need:

two 1x2 Plates

one Cross Axle Extension

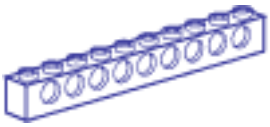
one Motor

Place the cross axle extension on the motor's cross axle. Stack the two 1x2 plates on top of each other and then place them to right of the motor's contact plate.

STEP 46

For this step, you will need:

two 3M Connector Peg with Friction



one 1x10 Beam

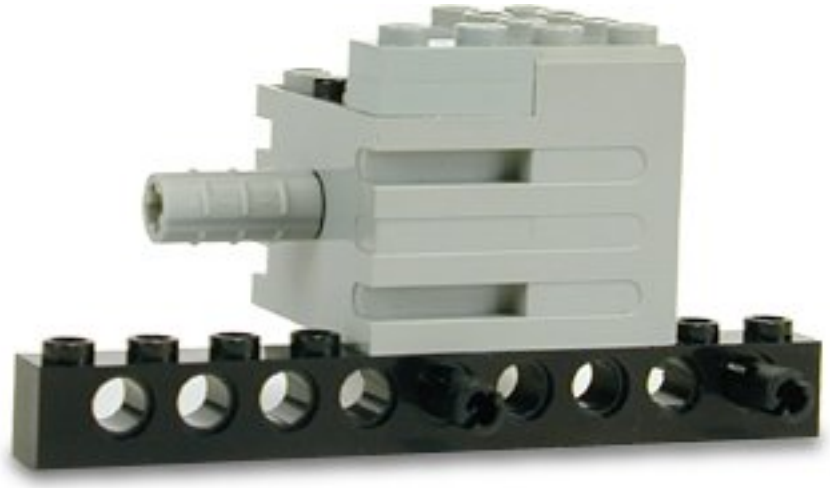
Place a 3M connector begs with friction into holes 5 and 9 of the 1x10 beam.

STEP 46A

Push the 3M connector pegs with friction all the way through the holes of the 1x10 beam.

STEP 47

Place the motor on the top of the 1x10 beam assembly on studs 5 through 8.



STEP 48

For this step, you will need:

one 3M Connector Peg with Friction

one 1x6 Beam

Place a 3M connector pegs with friction into holes 1 and 5 of the 1x6 beam.

STEP 48A

Push the 3M connector pegs with friction all the way through the holes of the 1x6 beam.

STEP 49

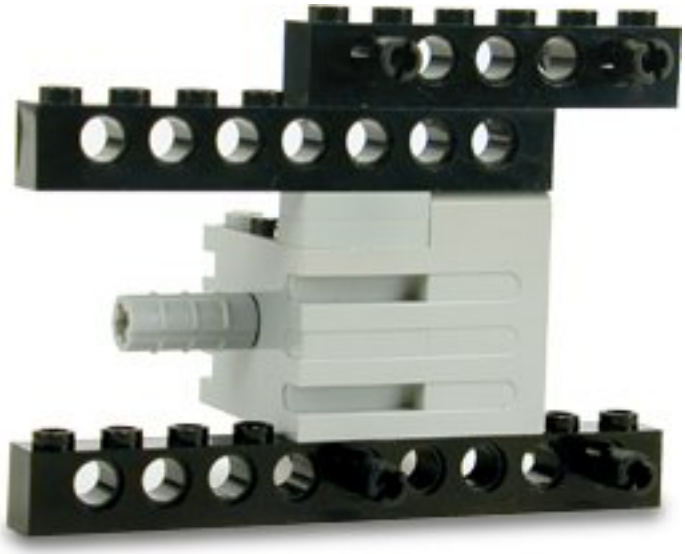
For this step, you will need:

one 1x8 Beam

Add the 1x8 beam to the 1x6 beam assembly you just created. Place your 1x6 beam assembly over studs 5 through 8 of the 1x8 beam.

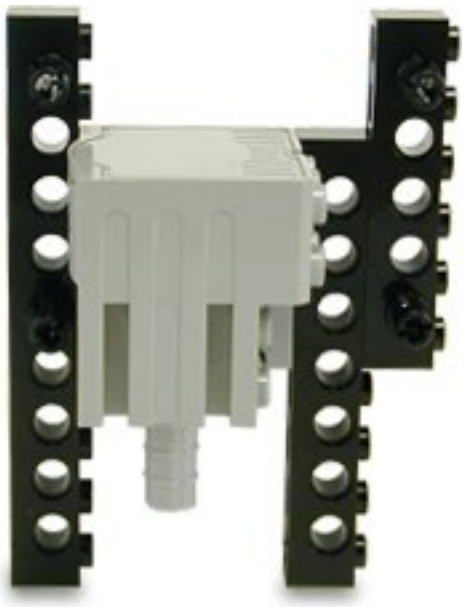
STEP 50

Place the 1x8 beam assembly on top of the motor assembly you created in Step 47.



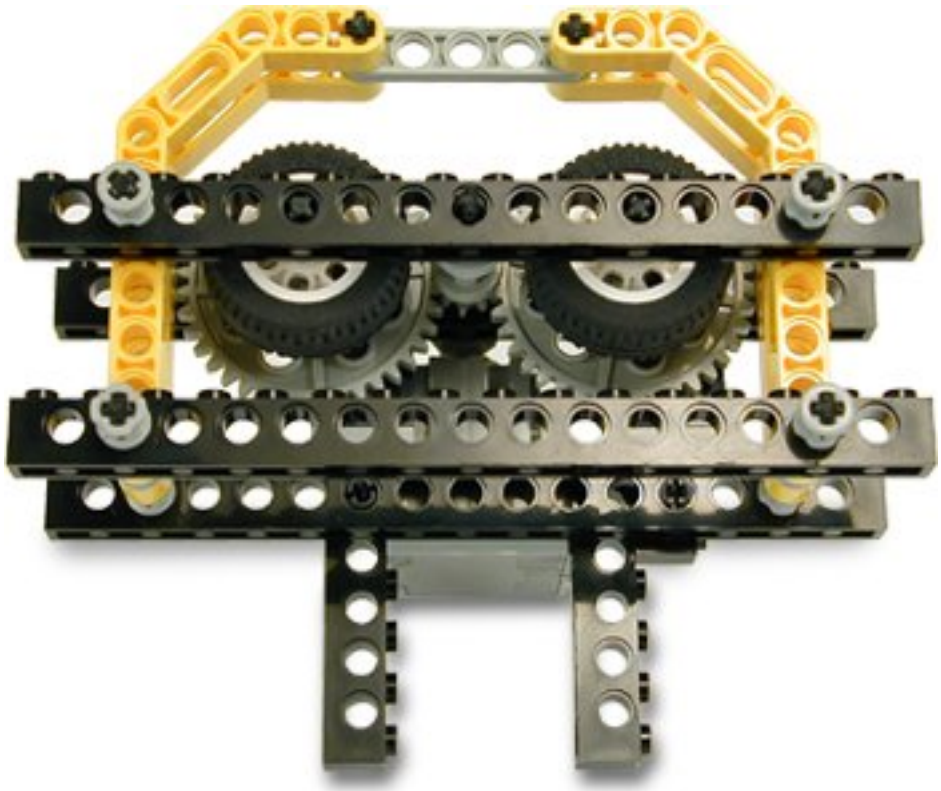
STEP 51

This time we want the motor's axle (and its cross axle extension) to face downward so that it can drive a hook or door apparatus.



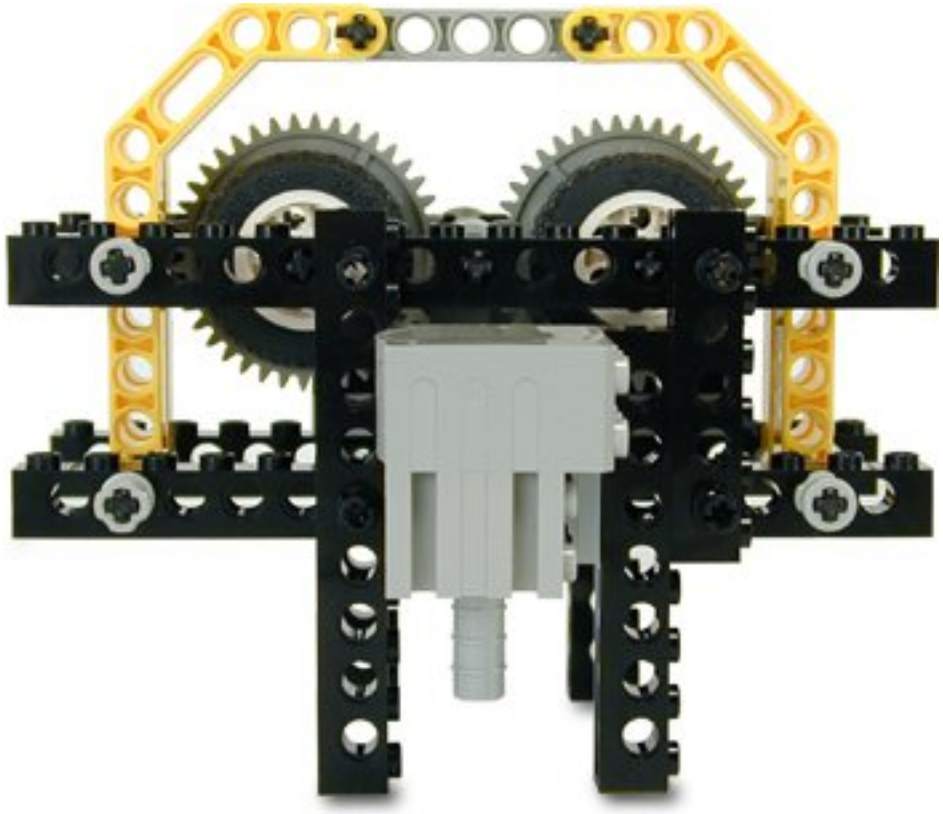
STEP 52

Position your larger construction so that the side without a motor is facing up.



STEP 53

Lock the left side of the motor assembly to your construction starting at the 6th hole of the 1x16 beams. The right side of your motor assembly should be connected to the 12th hole of the 1x16 beams.



At this point it is time to attach an RCX to your construction. There are of course many ways to do this, but click here to see our suggestion.

Connecting an RCX

STEP 1

Here are several easy steps to connect an RXC to your aerial tram.

For this step, you will need:


two Connector Peg with Friction


one Connector Peg with Knob


one 1x12 Beam

From the front of the 1x10 beam, insert the connector pegs with friction into holes 1 and 3. Insert the connector peg with knob into hole 5, making sure the knob side of the peg is on the outside.

STEP 2

For this step, you will need:


one Connector Peg with Friction


one Connector Peg with Knob


one 1x4 Beam

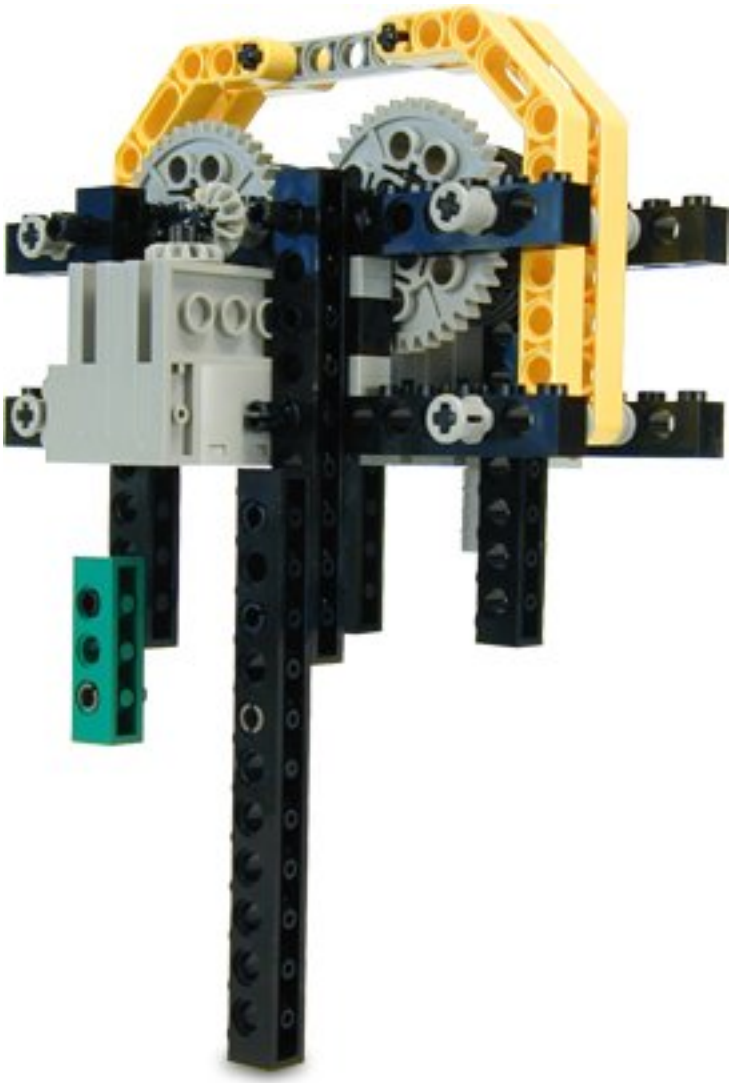
From the front of the 1x4 beam, insert the connector peg with friction into hole 1. Insert the connector peg with knob into hole 5, making sure the knob side of the peg is on the outside.

STEP 3

Grab your aerial tram construction and turn it so the motor assembly that drives the tram faces towards you.

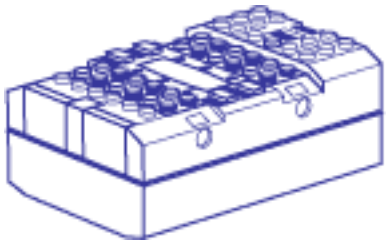
Lock the 1x12 beam assembly to holes 1 and 3 of the 1x10 beam just to the right of the motor. Make sure the knob section is still visible at the bottom of your consturction.

Lock the 1x4 beam assembly to hole 1 of the 1x6 beam just to the left of the motor. Make sure the knob section is still visible at the bottom of your consturction.



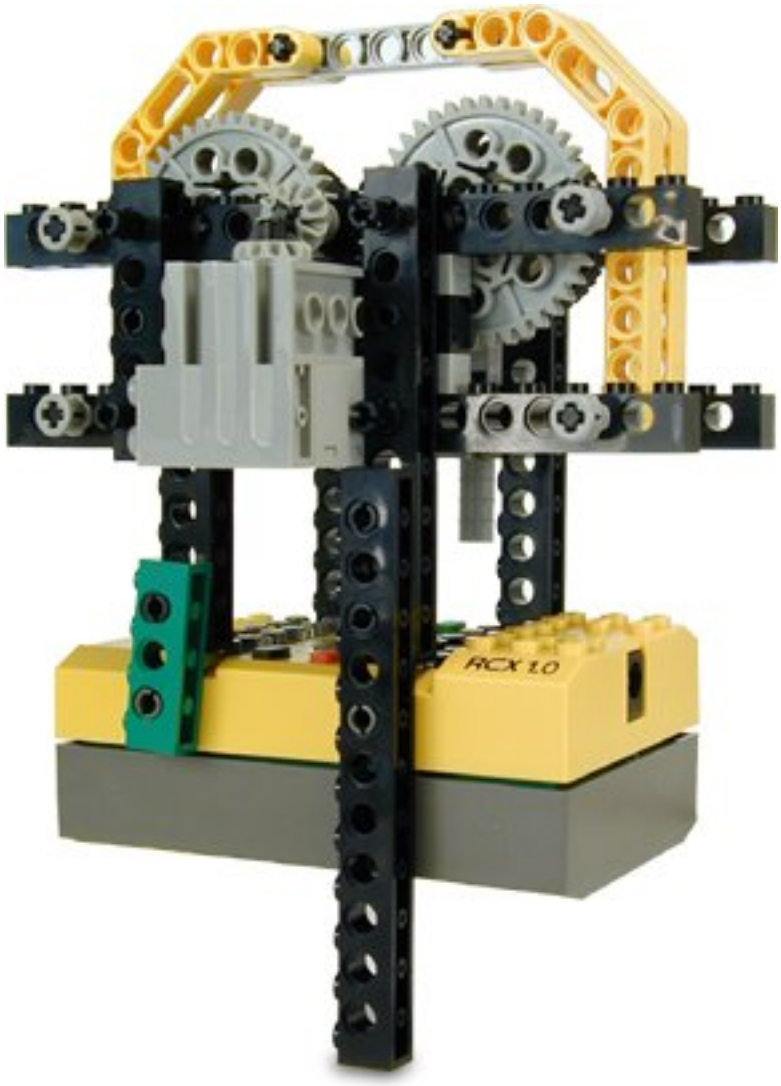
STEP 4

For this step, you will need:



one RCX

Lock your RXC into place by connecting it to the 2 knobs at the bottom of your tram construction.



STEP 5

For this step, you will need:

two Connector Peg with Friction

one Connector Peg with Knob

one 1x12 Beam

From the front of the 1x10 beam, insert the connector pegs with friction into holes 11 and 9. Insert the connector peg with knob into hole 7, making sure the knob side of the peg is on the outside.

STEP 6

For this step, you will need:

one Connector Peg with Friction

one Connector Peg with Knob

one 1x4 Beam

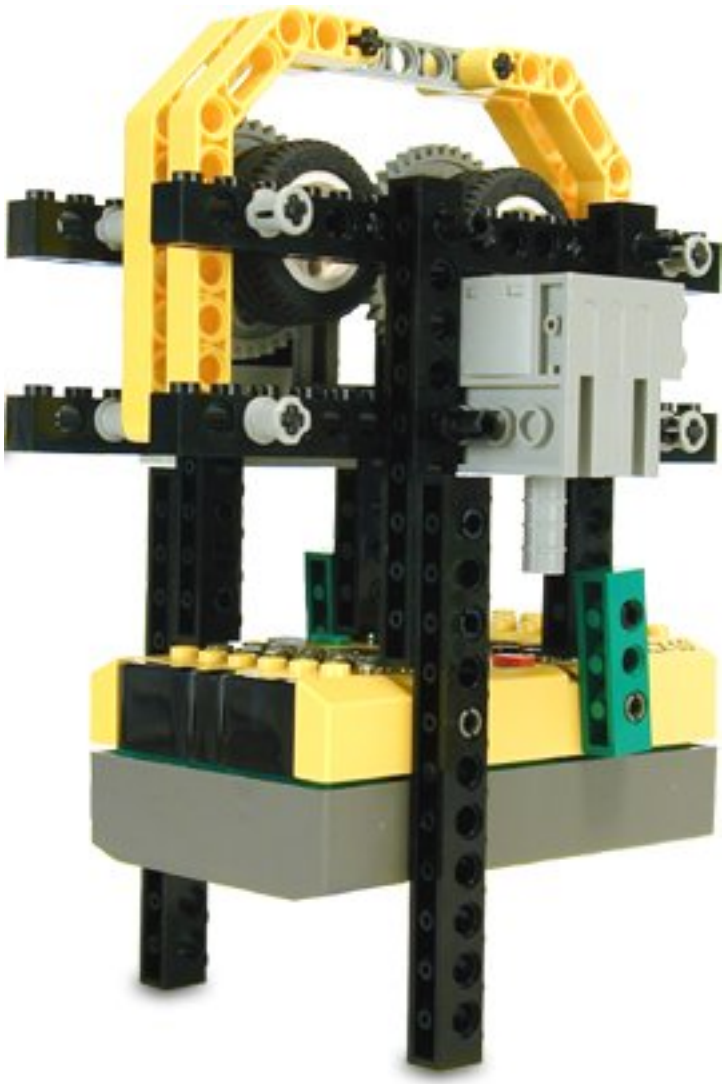
From the front of the 1x4 beam, insert the connector peg with friction into hole 3. Insert the connector peg with knob into hole 1, making sure the knob side of the peg is on the outside.

STEP 7

Turn your aerial tram construction over so the motor assembly that drives components (the motor that points down) faces towards you.

Secure the RCX by locking your 1x12 beam assembly into place so it matches the opposite 1x12 beam assembly.

Finally, lock the 1x4 beam assembly into place so it matches the opposite 1x4 beam.



CONGRATULATIONS! Now that your RCX is connected to your Aerial Tram you should think about programming the RCX or connecting more assemblies, such as a basket or a claw, to the bottom of your construction.

To do this go to the Missions section to get some ideas on how to approach these challenges.