

Snek Lesson #4: The Washing Machine

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1. The Washing Machine

Both the line bug and bumper car only had to react to the environment. They did not have to remember or follow a sequence of actions (beyond controlling the motor). This project, requires stepping through a prescribed set of states to act like a simple washing machine.

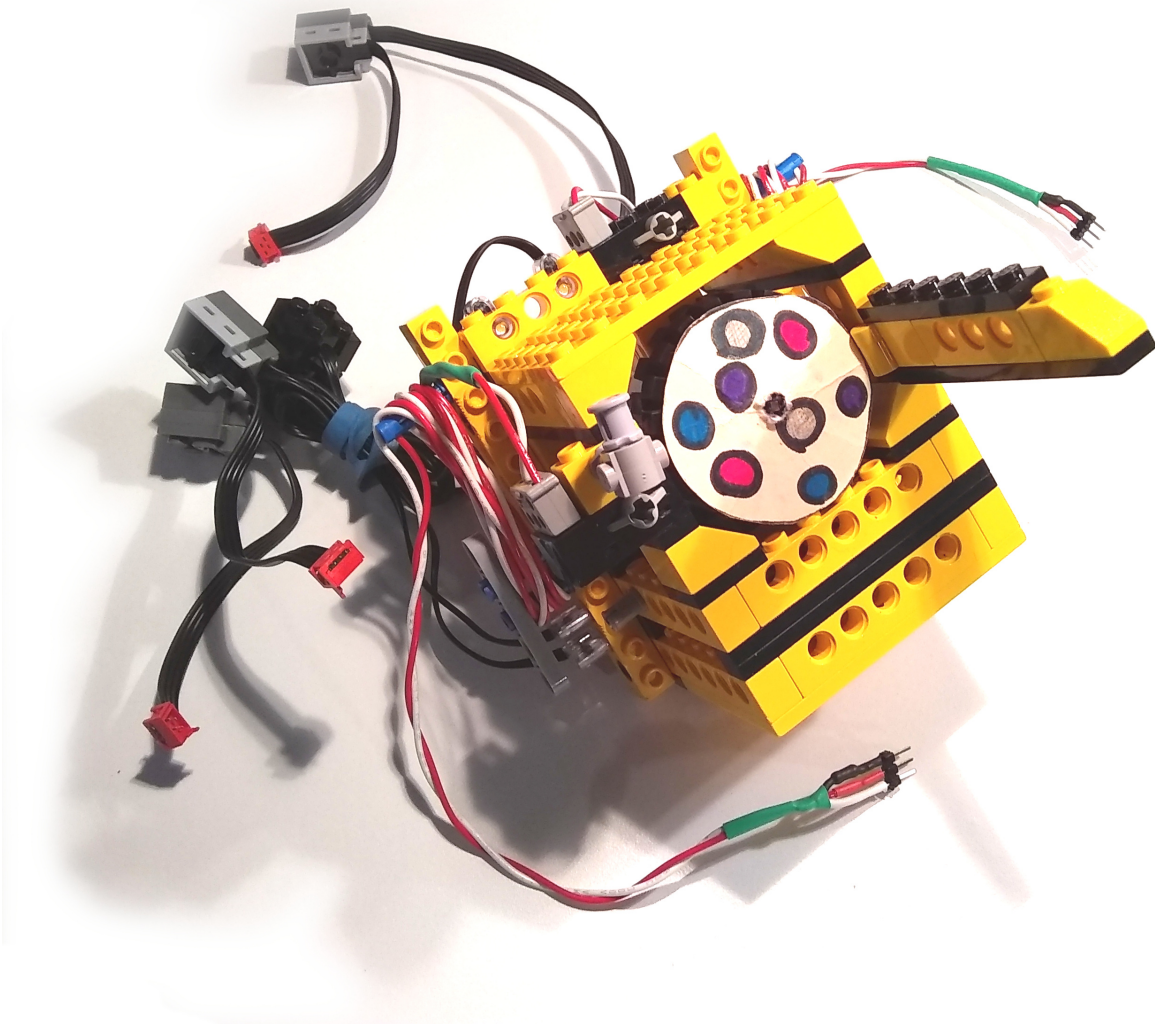


Figure 1. Washing Machine

Important features:

- One motor to rotate the washer drum (the blobby disc of clothes).
- Two touch sensors: one for control and one for the door. The red=power and white=signal wires mean the switch will be high when pressed and pulldown() should be used before reading it.
- Two LEDs to indicate the machine state.

The goals of this lesson are to build a model which does the following:

- Before starting, the door needs to be closed
- The control button starts a wash.
- To wash: rock back and forth for a while

- To spin: rotate fast
- Use the lights to indicate what's going on

Unlike the Line Bug and Bumper Car, which respond immediately to their environment this model runs through a sequence of fairly complicated operations.

Rather than try to write the program in complete detail on the first attempt, we'll start by writing pieces of the program and then put them together at the end.

1.1. Washing Clothes

If you've ever watched a washing machine at work, you'll see it slosh the clothes back and forth through sudsy water. We'll simulate that by slowly rocking the "drum" several times, alternating first in one direction and then the other.

To go in one direction and then the other means using `setright` and `setleft` before turning the motor on for a short time. We'll use a lower power setting so that the drum doesn't appear to go too fast. That might look something like this:

```
def Slosh():  
    talkto(M1)  
    setpower(0.5)  
    setleft()  
    onfor(1)  
    setright()  
    onfor(1)
```

The For Loop

The for loop asks snek to count, and then do something each time. It will count using numbers by using the `range` function. That tells snek how far to count. Snek starts counting at 0 and stops counting just before it reaches the value given to `range`. If you give `range` the value 5, then Snek will count 0, 1, 2, 3, and finally 4. This is five different numbers, so `range(5)` means to count five times starting at 0.

```
> for i in range(5):
+   print(i)
+
0
1
2
3
4
>
```

We need to `Slosh` several times in a row. We'll do that with a for loop. Let's write a `Wash` function that runs the `Slosh` function ten times:

```
def Wash():
    for i in range(10):
        Slosh()
```

You can adjust the number of times it sloshes, the speed of sloshing and the length of time it sloshes in each direction by changing the numbers in these two functions.

1.2. Spinning To Wring Out the Water

After washing the clothes, the washing machine needs to get as much of the water out as possible. Otherwise, your clothes would take a lot longer to dry. It does this by using centrifugal force. By spinning the drum quickly, much of the water in the clothes is drawn out through holes in the drum and drained away.

We'll simulate that by running our motor at high speed for a while like this:

```
def Spin():  
    talkto(M1)  
    setpower(1)  
    setright()  
    onfor(5)
```

This time, we make the motor go as fast as it can for five seconds. You can make it go longer, switch directions or whatever else you like by changing this function.

1.3. Waiting For Switches

We want our washing machine to wait until the door is closed and the start button is pressed before washing the clothes. For each switch, we'll want to keep checking to see if it has been pressed using a `while` loop. Recalling what we learned in lesson 1 about switches, we need to use the `pulldown` function so that our on/off switches work correctly. Putting those together, we might create a `WaitSwitch` function like this:

```
def WaitSwitch(switch):  
    pulldown(switch)  
    while not read(switch):  
        pass
```

1.4. Putting The Program Together

Now that we've got most of the pieces of our washing machine ready, we can assemble them together by writing a master function, `WashCycle` that does the steps in the order we defined above:

- Door closed
- Start button pushed
- Wash
- Spin
- Done

That program might look like this:

```
def WashCycle():  
  
    # Wait for door to be closed  
    WaitSwitch(A1)  
  
    # Wait for start button  
    WaitSwitch(A8)  
  
    # Wash the clothes  
    Wash()  
  
    # Spin them to wring out some water  
    Spin()  
  
    # All done!
```

1.5. Indicator Lights

We've stuck a couple of lights on our washing machine to tell the user what is happening. Let's add a couple of functions to turn them on and off:

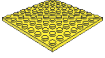
```
def LightOn(light):  
    talkto(light)  
    setpower(1)  
    on()  
  
def LightOff(light):  
    talkto(light)  
    off()
```

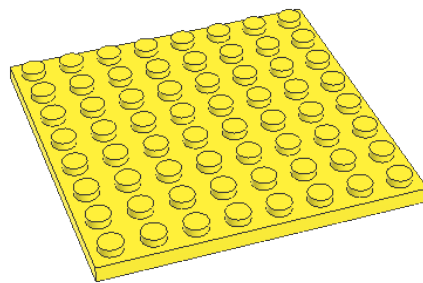
We can use these wherever we like. One option is to turn one light on during the wash cycle and the other during the spin cycle. Another idea is to turn one light on when the door is closed, the other while the cycle is going, then turn the first off when the door is opened again.

Appendix A: Building The Washing Machine



Follow the next few pages to complete the construction of your washing machine.

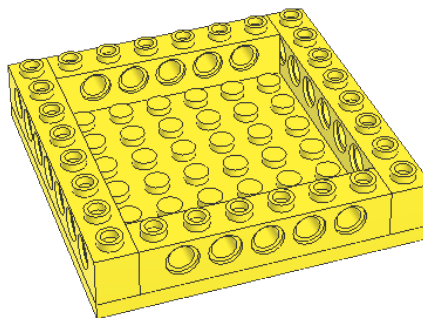
A.1. Step 1

Part	Description	Color	Count
	Plate 8 x 8	Bright Light Yellow	1




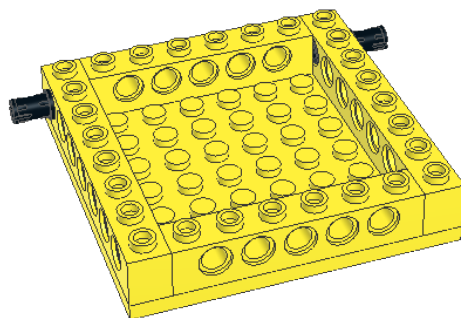
A.2. Step 2

Part	Description	Color	Count
	Technic Brick 1 x 8 with Holes	Bright Light Yellow	2
	Technic Brick 1 x 6 with Holes	Bright Light Yellow	2




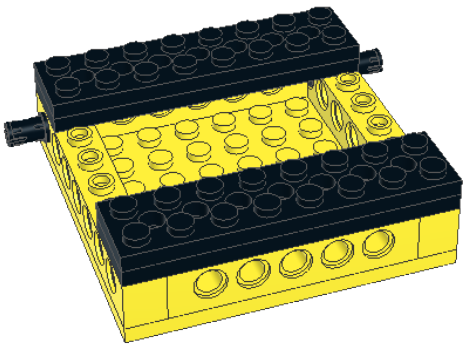
A.3. Step 3

Part	Description	Color	Count
	Technic Pin with Friction	Black	2





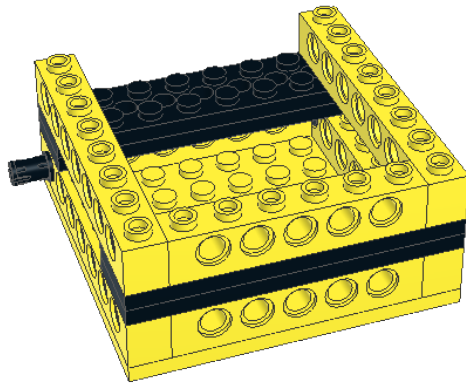
A.4. Step 4

Part	Description	Color	Count
	Technic Plate 2 x 8 with Holes	Black	4





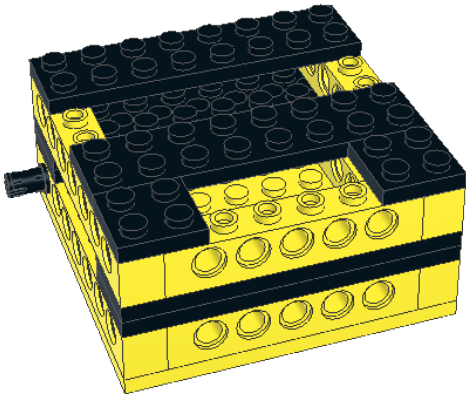
A.5. Step 5

Part	Description	Color	Count
	Technic Brick 1 x 8 with Holes	Bright Light Yellow	2
	Technic Brick 1 x 6 with Holes	Bright Light Yellow	1


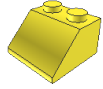
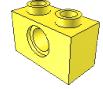


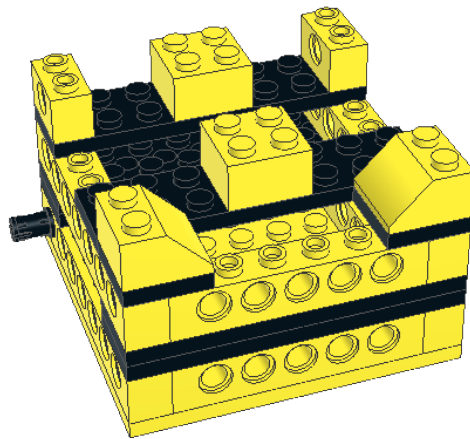
A.6. Step 6

Part	Description	Color	Count
	Plate 2 x 2	Black	2
	Plate 2 x 8	Black	2




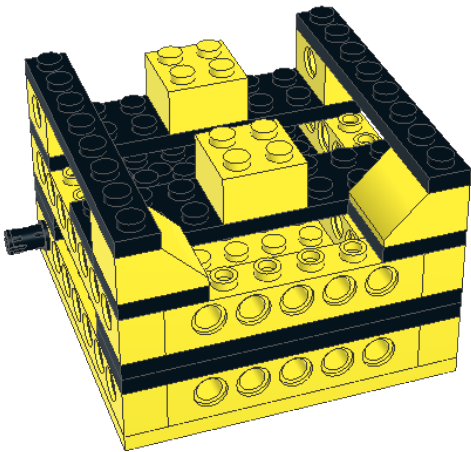
A.7. Step 7

Part	Description	Color	Count
	Brick 2 x 2	Bright Light Yellow	2
	Slope Brick 45 2 x 2	Bright Light Yellow	2
	Technic Brick 1 x 2 with Hole	Bright Light Yellow	2







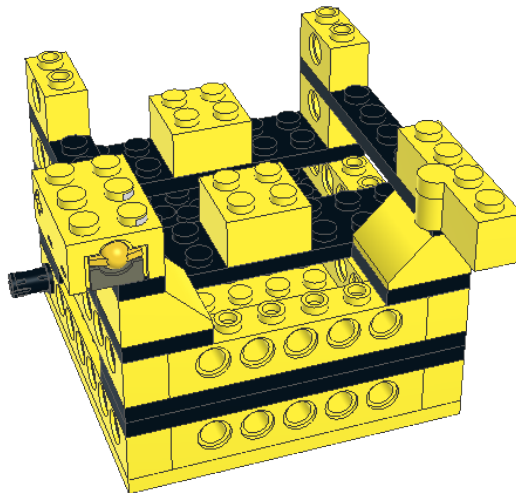
A.8. Step 8

Part	Description	Color	Count
	Plate 1 x 8	Black	2







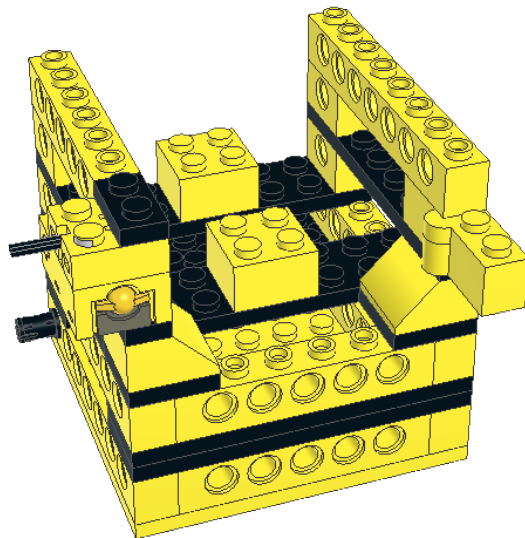
A.9. Step 9

Part	Description	Color	Count
	Technic Brick 1 x 2 with Hole	Bright Light Yellow	2
	Hinge Brick 1 x 4 Top	Bright Light Yellow	1
	Hinge Brick 1 x 4 Base	Bright Light Yellow	1
	Electric Brick 2 x 3 Sensor Touch	Bright Light Yellow	1







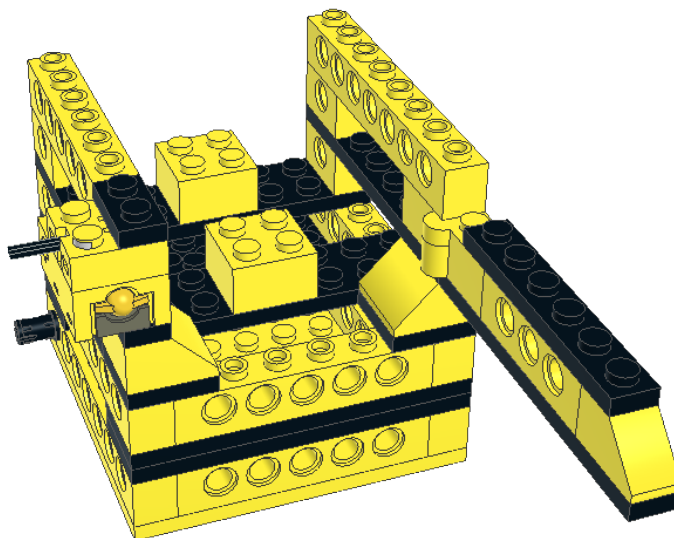
A.10. Step 10

Part	Description	Color	Count
	Plate 1 x 2	Black	1
	Technic Brick 1 x 8 with Holes	Bright Light Yellow	1
	Technic Brick 1 x 6 with Holes	Bright Light Yellow	1
	Electric Brick 2 x 2 x 2/3 with Wire End	Bright Light Yellow	1





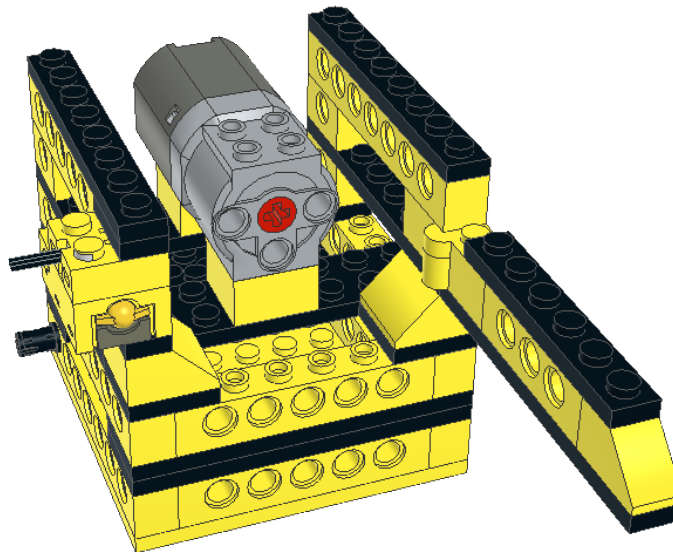
A.11. Step 11

Part	Description	Color	Count
	Slope Brick 45 2 x 1	Bright Light Yellow	1
	Plate 1 x 8	Black	1
	Plate 1 x 6	Black	1
	Technic Brick 1 x 4 with Holes	Bright Light Yellow	1






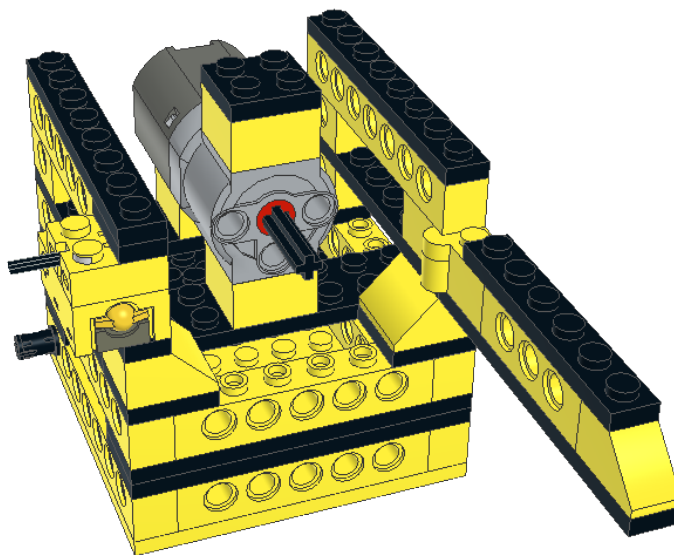
A.12. Step 12

Part	Description	Color	Count
	Electric Power Functions 2.0 Medium Motor	Dark Bluish Grey	1
	Plate 1 x 8	Black	2

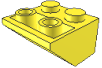



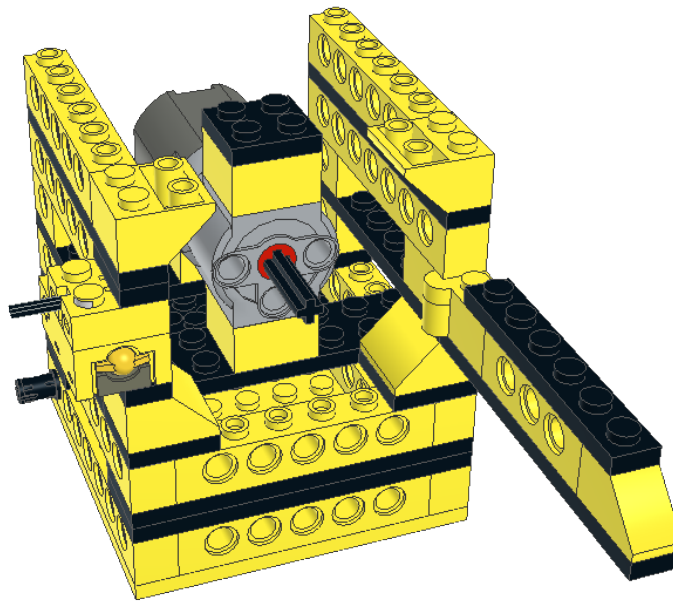
A.13. Step 13

Part	Description	Color	Count
	Brick 2 x 2	Bright Light Yellow	1
	Plate 2 x 2	Black	1
	Technic Axle 3	Black	1

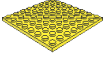


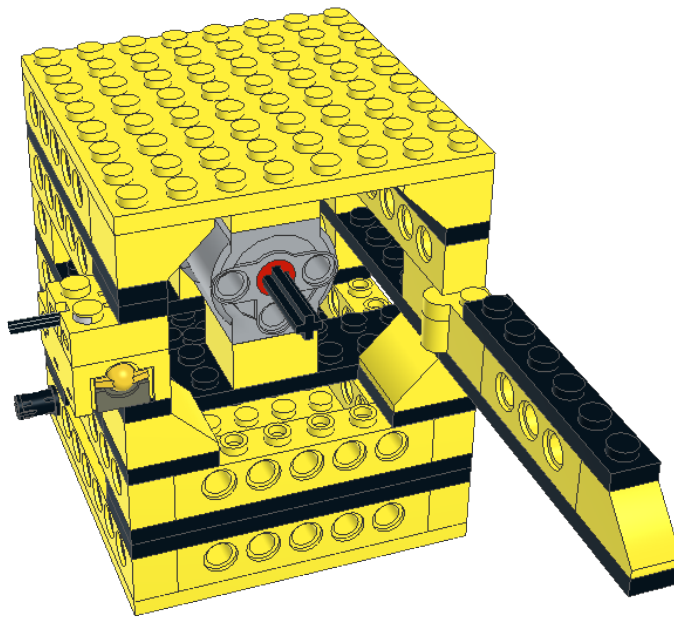
A.14. Step 14

Part	Description	Color	Count
	Slope Brick 45 2 x 2 Inverted	Bright Light Yellow	2
	Technic Brick 1 x 6 with Holes	Bright Light Yellow	2






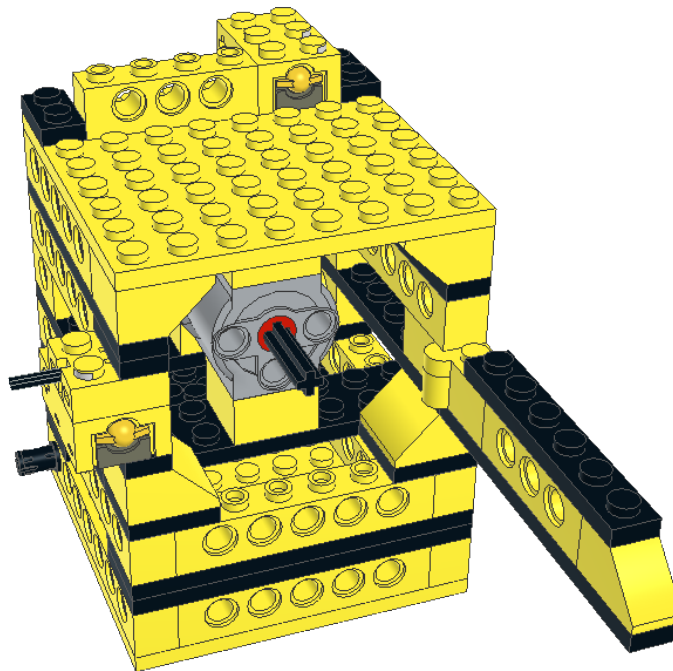
A.15. Step 15

Part	Description	Color	Count
	Plate 8 x 8	Bright Light Yellow	1





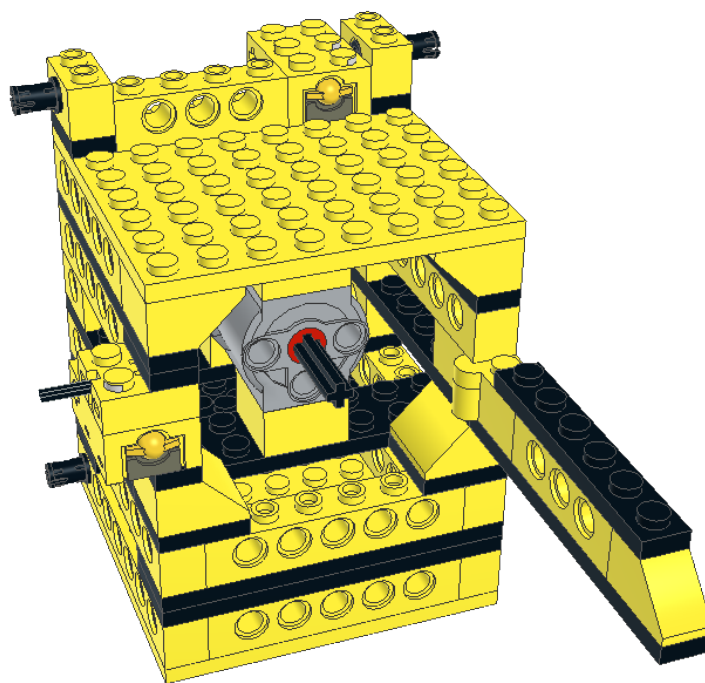
A.16. Step 16

Part	Description	Color	Count
	Plate 1 x 2	Black	2
	Technic Brick 1 x 4 with Holes	Bright Light Yellow	1
	~Moved to 75973	Bright Light Yellow	1




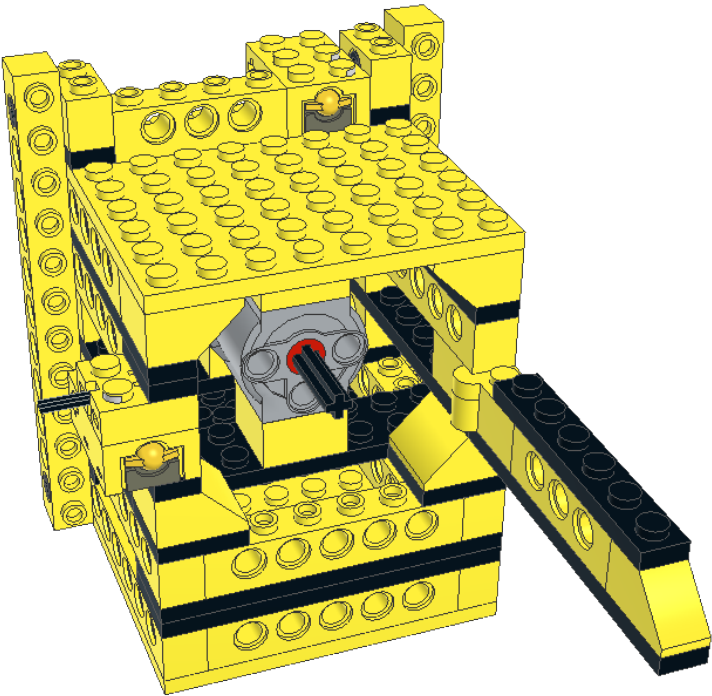
A.17. Step 17

Part	Description	Color	Count
	Technic Brick 1 x 2 with Hole	Bright Light Yellow	2
	Technic Pin with Friction	Black	2






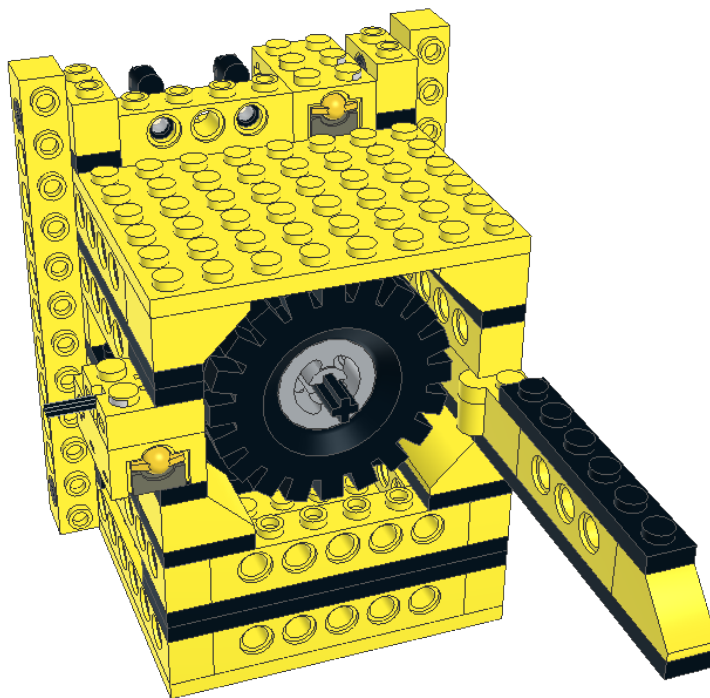
A.18. Step 18

Part	Description	Color	Count
	Technic Brick 1 x 2 with Holes	Bright Light Yellow	2



A.19. Step 19

Part	Description	Color	Count
	Wheel Rim 8 x 17.5 with Axlehole	Light Bluish Grey	1
	Tyre 10/130 x 17 Offset Tread	Black	1
	Electric Power Functions Light with Cable Horizontal	Black	2



A.20. Wiring The Washing Machine

Here's one way to wire up the washing machine. If you wire it up differently, you'll need to adjust for that when programming the robot.

1. Connect the motor driving the drum to M1.
2. Connect the door switch A1 and the switch on top to A8. Make sure you insert the connectors the right way, with the black wire towards the center of the snekboard and the yellow or white wire towards the edge.
3. Connect the lights to M2 and M3.

