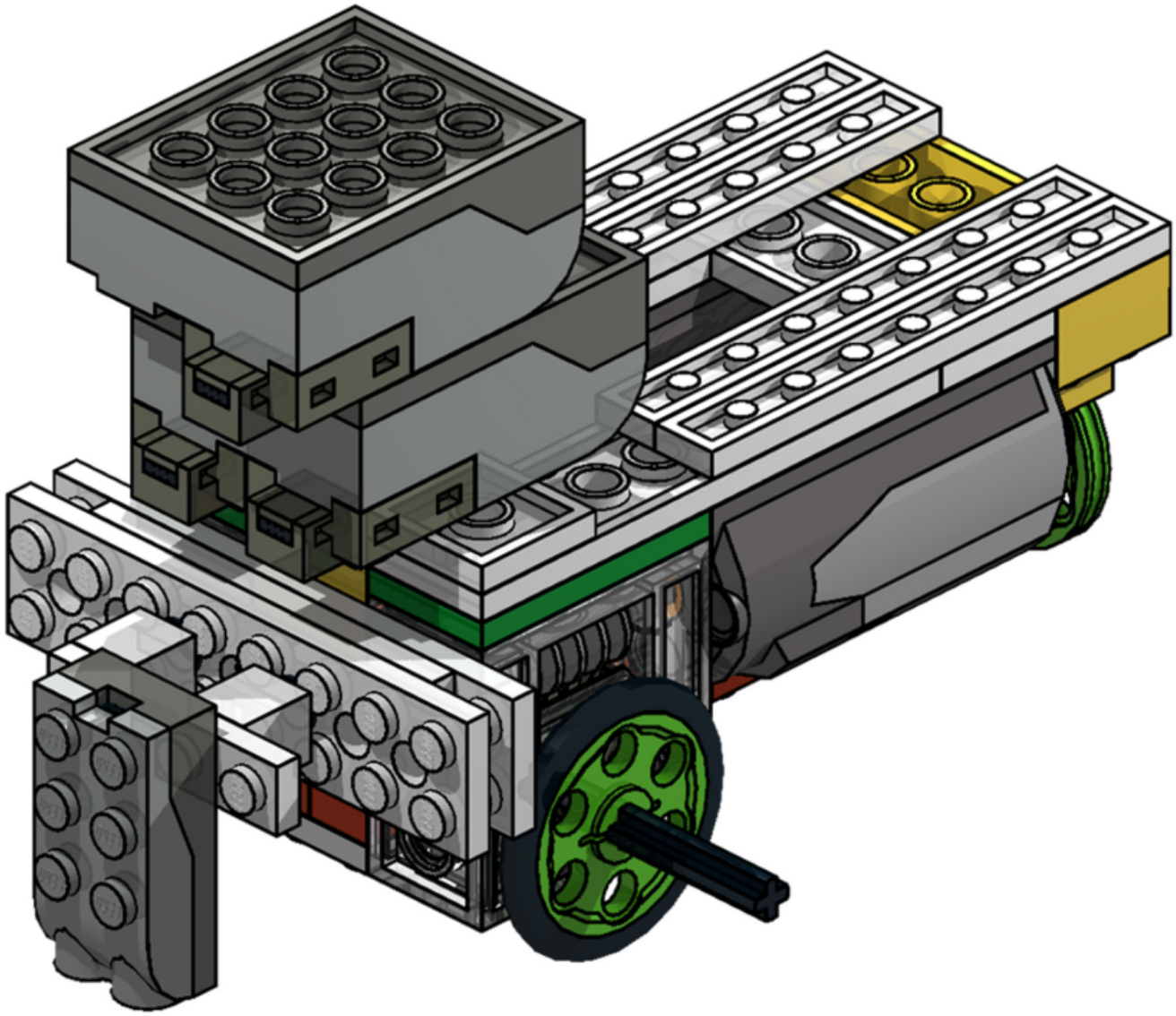
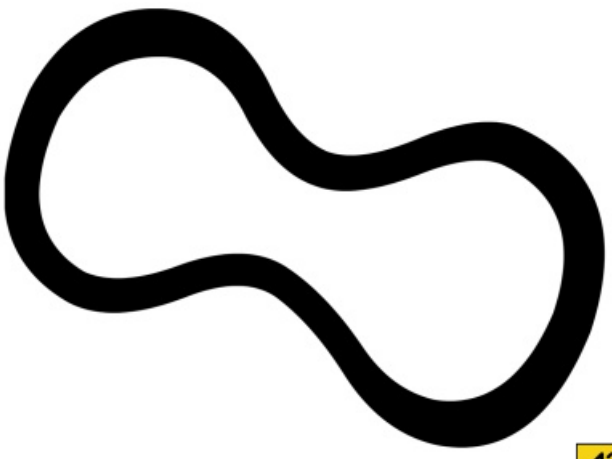
Robotics with LEGO® WeDo (VIII)



An introduction to robotics for the young with LEGO® WeDo: Line Follower

By Diego Gálvez

In this installment, I will explain in detail how to build and program a line follower using the materials included in the LEGO® WeDO set.



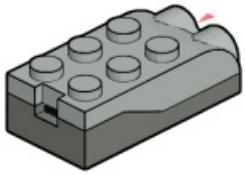
Construction

You will need two standard LEGO® WeDo sets to build a line follower.

The instructions can be found on my blog notjustbricks[1] (the web address can be found at the end of the article). There you will also find a track to try out the line follower.

Before beginning, it is recommended that this experiment be done in a setting where the light is uniform (avoiding shadows), so that the sensor gets the most accurate reading.

Since the LEGO® WeDo set does not come with a light sensor (as is the case for NXT or EV3), for this experiment you will use the motion (distance) sensor as the light sensor.

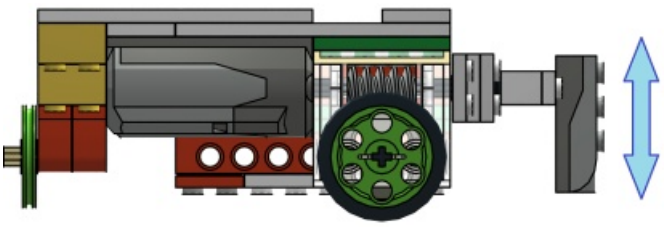


Sensor Calibration

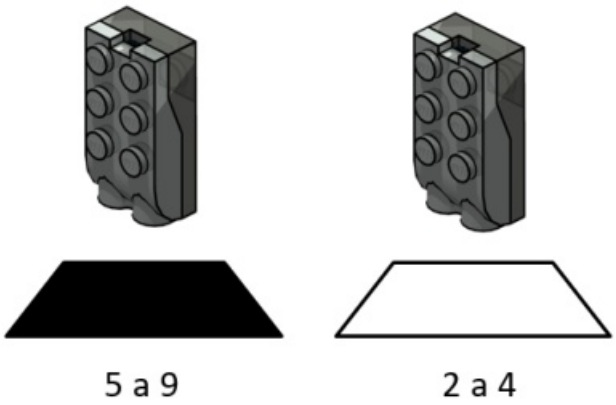
Place the line follower on the track. With the WeDo software make a program that copies the sensor readings on the screen.

Observe the sensor readings at different points along the track, both on the white and black area.

If you do not observe a noticeable change in the sensor reading, chances are you need to adjust the sensor's distance from above the track.



The values given below are the results obtained with the motion sensor I used. These values should be taken as reference and will not necessarily match those that you get, as it depends on the **lighting** and the **motion sensor** itself.

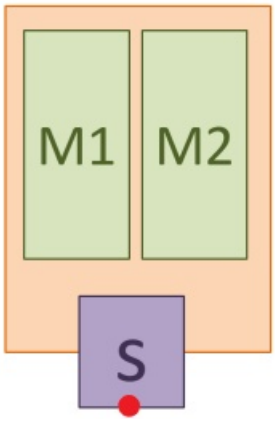


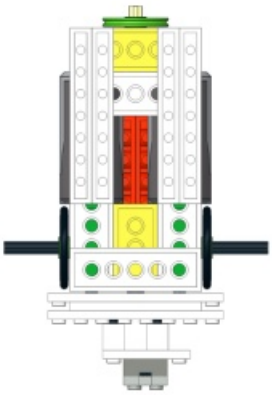
In our case, a reading of 2 to 4 was obtained when the sensor was above the white surface, and a reading of 5 to 9 was obtained when the sensor was above the black surface.

It can be said that when the sensor yields a value greater or equal to 5, the surface is black; otherwise, it is white.

Connection

To avoid confusion between the two motors, we'll name them M1 and M2, as shown in the figure below (view from above).





When connecting, the software should recognize which motor is which.

In the following case, M1 is the motor with one circle and M2 is the motor with two circles.

STEP

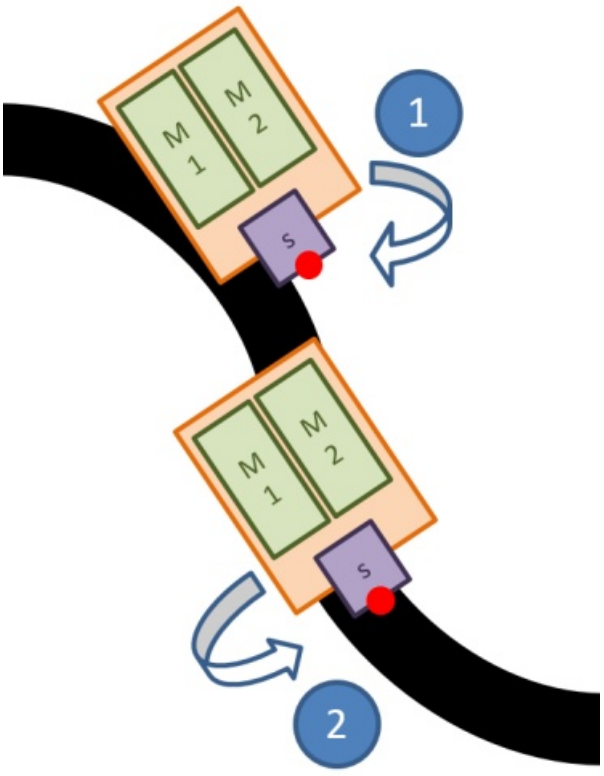
To be able to more easily understand the algorithm, the concept of ‘steps’ will be defined first.

For the purpose of this experiment a ‘step’ is the powering of the motor for a small period of time. In the case of the line follower, we have defined what a ‘step’ is for M1 and M2.

Testing them both out, you will be able to see the ‘steps’ for both motors.

ALGORITHM

The algorithm for the line follower has two cases.



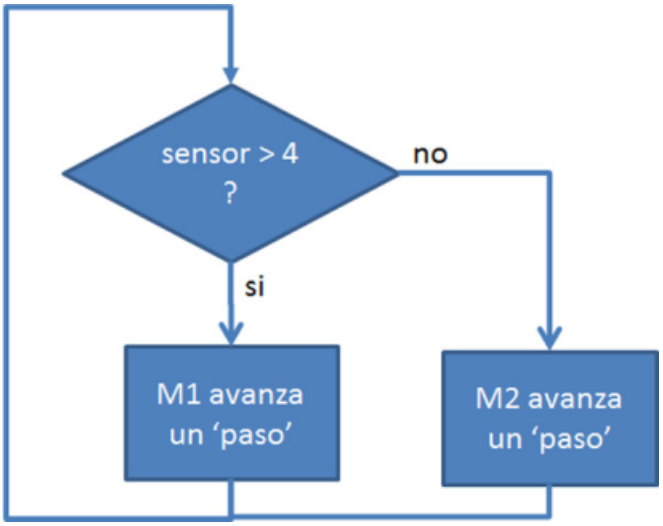
Case 1:

If the sensor reads «white» M2 advances one “step”.

Case 2:

If the sensor reads «black» M1 advances one “step”.

Both cases should be locked in an infinite loop so that the sensor (reading white or black) continues processing.



Block diagram

WeDo Program

To ask if the sensor’s value is greater than 4, we will use the sending and receiving blocks.

The first part consists of sending the value that the motion sensor is reading. In order for the reading to continue updating, we will place it in an infinite loop block.

The message values will range from 0 to 10.

As calculated in the beginning, the sensor gives values ranging from 2 to 4 on a white surface and 5 to 9 on a black surface.

Now the message receiving blocks are created. For values 2, 3, and 4 the ‘step’ for M2 is added, and for values 5, 6, 7, 8, and 9, the ‘step’ for M1 Is added.

In the example shown, the cases were added for 0 and 1 upon detection of white and 10 upon detection of black. Although not necessary, to avoid any undesired outcome it is good to include the full range of sensor values (0 to 10).

Reading on a black surface

Reading on a white surface

Recommendation

When testing the line follower, hold up the HUBS USB cables since these, due to their weight, may cause the prototype to move.
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[1] On the web page http://notjustbricks.blogspot.com you will find multimedia material of the author's own creations, some with building instructions.