Lego Mindstorms®

Dortmund - Esbjerg Comenius Project

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Problem

Create a robot that is able to follow a line through an oval course.
The robots will be evaluated on the following fields:
Fastest time around the course
Best design

Problem analysis

As we only had one light sensor available, we knew we had to take a different approach to the programming, compared to the groups using two light sensors. With two light sensors it's easiest to make a switch that continually checks whether the two light sensors are hovering over the black line. If the left sensor is outside the black line, but the right one is on it, the robot will then respond by turning right, to ensure that it does not go off-course. The same applies to the opposite scenario. This will make the robot slowly wriggle its way forward.
We figured it would be possible to utilize our single light sensor build optimally by making the robot respond to the black line, by decreasing the power supply on the inner tire. This will make the robot turn inwards, therefore ensuring that it does not cross the black line, and going off-course.

Approach

On day one we built a prototype robot, but it was too wide and therefore couldn't stay on the line / in the circle. The programming was almost identical to the one used in the final build, but the robots design was bad.
On day two we rebuilt the robot from scratch, using a thinner design with the tires closer together. This design allowed the robot to make smaller adjustments to its trajectory. We also adjusted the programming, so the wheels never stop turning. Instead the power supply for the tires is adjusted, to make the robot turn.
To optimize the building process, we split the tasks, so everyone would be able to work on something at the same time.

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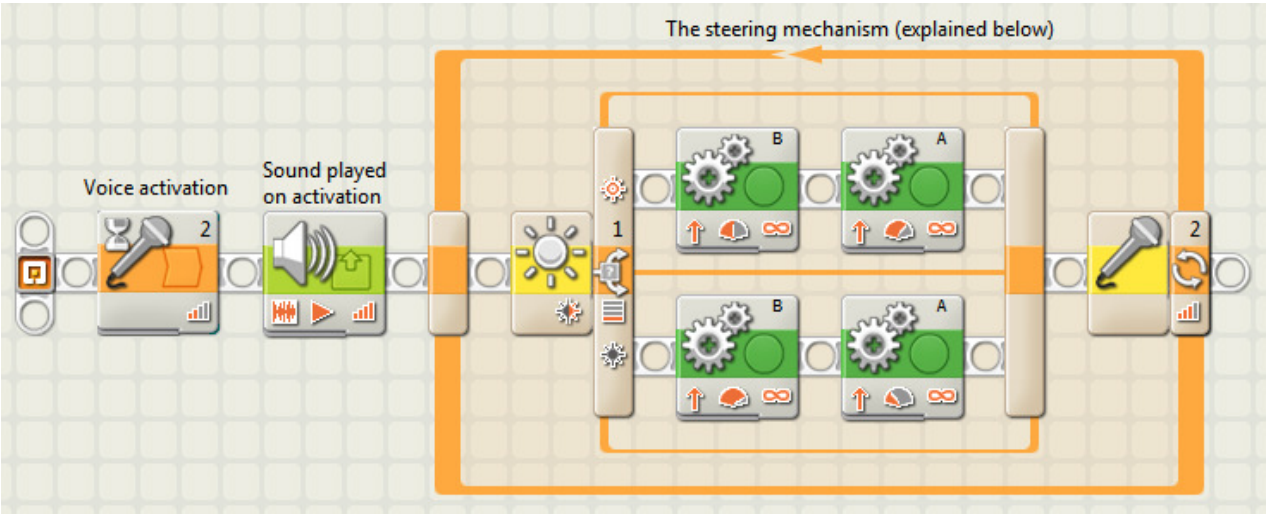
Table of division of labor	
Tom	Robot design, testing, documentation, building instructions
Christoph	Robot design, building instructions
Jan	Robot design, programming, building instructions
Benjamin	Robot design, testing, video documentation
Christian	Programming, documentation, video documentation

Solution

Programming



The whole steering mechanism is made in a switch within an endless loop. This makes the robot continually check whether the light sensors input, is over or under the threshold. If the light sensor is on the black line, the robot will reduce the power input for the engine powering the right tire. If the light sensor is on the white paper, the power input on the left tire will be 100% and the right wheel 98% to assist in getting around the oval course. The robot can be stopped by clapping, and activating the sound sensor.

Input / output setup	
Input	Output
1: Light sensor	A: Right engine
2: Sound sensor	B: Left engine
3: Inactive	C: Inactive
4: Inactive	

Robot

See Documentation, Building process.

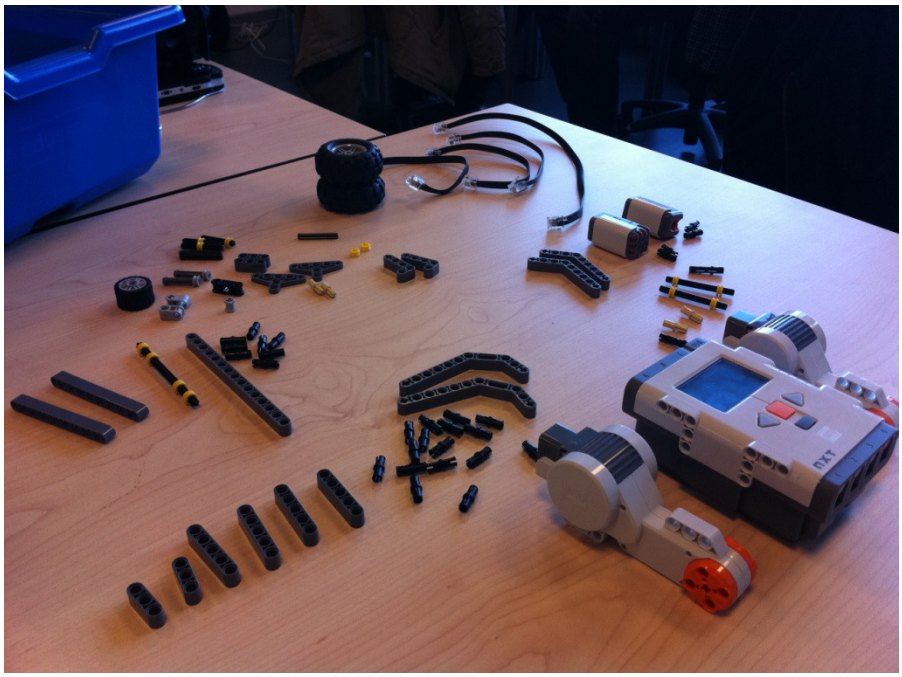
Conclusion

We have constructed a robot that is specialized at driving around this specific course. It is only able to drive clockwise because of our programming and the fact that we only had one light sensor available.
All in all we are very satisfied with the outcome of our project.
Our team worked effectively, most of the time, and we got a lot of things done, in a limited timeframe.
Average time of lap completion: 6, 6 seconds

Documentation

Building process

Components of the robot

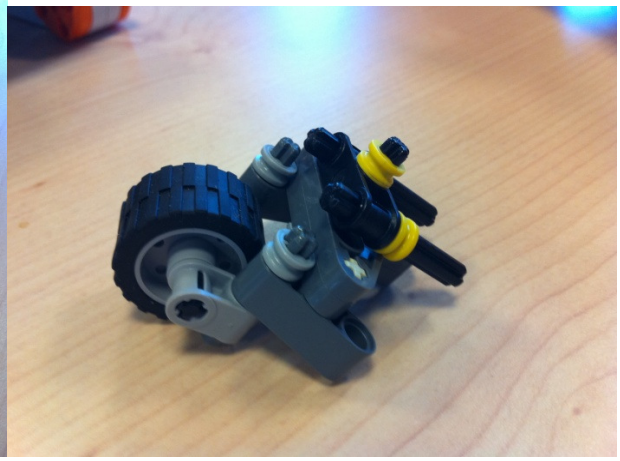


Step 1

Connecting Mindstorms and engines

Step 2

Building the free back wheel



Step 3

Adding light and sound sensor.

Step 4

Adding wheels

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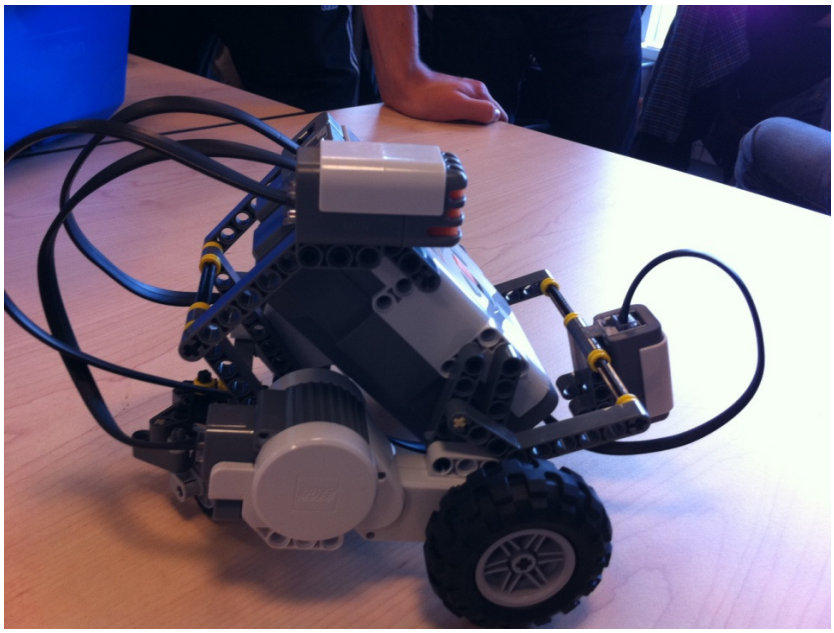
Step 5

Connecting wires



It's finished

Video documentation

We have made a time lapse video of the robot construction, and a short video of the robot running around the course.

The video documentation can be found at:

http://www.youtube.com/krulemut

Direct links:

http://www.youtube.com/watch?v=wGAy8KP3CeU

http://www.youtube.com/watch?v=JGPfz0ZQEw8

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