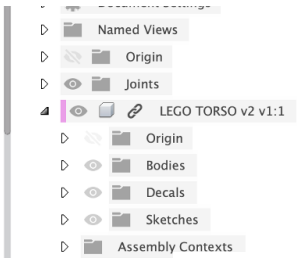
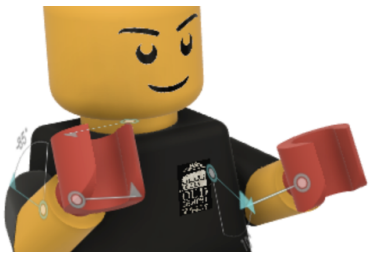
IoT Project: Self-Driving-Car





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Description Assignment

Mercedes-Benz wants to automate its museum in Stuttgart. To do this, they want a system, which will allow a visitor to take a seat in a self-driving car. At the beginning of the tour, the visitor can take place in one of these cars that will drive around the entire museum. At the end, the visitor gets out and the trolley returns to the beginning of the tour so that new visitors can embark.

The route that the cars have to follow is fixed with a white tape on the floor, which makes it possible to adapt the tour if new exhibits are added. At each exhibit, a transverse white line will cross the tour line, this way the car knows where a museum piece is exhibited and that it has to stop. If the driver wants to continue, he or she can press a push-button inside the car and the tour will continue to the next exhibited item.

To avoid congestion, the car will automatically continue the tour after 5 minutes. Optionally, they also want to operate the cars remotely, for which the Control Center could take over the function of the push-button with an app.

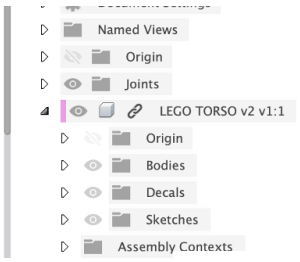
Of course it is also important that the cars do not collide, therefore there should always be a minimum distance of 1.5 meters between the trolleys (Corona measures). If a car detects that it is too close to the one in front, it must stop and only continue if the one in front also continues to drive.

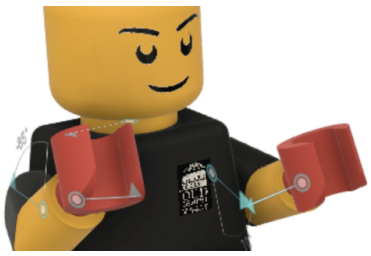
The cars are also equipped with LEDs. Using this signalization, the staff present in the control room can check cameras should there be a problem.

- A green LED will light up if there are no issues.
- A red LED will light up if the car has lost track of the white line.
- A orange LED will light up if the car detects an obstacle (other car or anything else in its path).

Requirements:

- The car can autonomously follow a track indicated by a white line.
- The car must stop at a white line and can only continue driving if:
    - The driver pushes the drive-through push-button.
    - The trolley has been stationary for 5 minutes.
    - Optional: when the control center activates the car with their custom made application.
- The cars must not collide.
    - If a car is halted, the cars behind it will keep their distance and only continue their route when the car in front of them continues its path.





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- Should there occurre problems with a car, it will be forced to stop and inform the control center by means of LEDs mounted on the cars.
    - Signalization in case of problems:
        - Green LED: No issues.
        - Orange LED: Obstacle (other car or anything else in its path).
        - Red led: car has lost track of the white line.

What does Mercedes-Benz expect:

- A brief description of the used hardware.
    - Files to produce the enclosure.
    - Electronic components.
    - Schematics and PCB (if applicable).
- Documented code.
- Brief description of to produce these cars themselves.
    - Tutorial.

All of this will be provided to them through a GitHub page.

Follow-up:
Mercedes-Benz wants to take the cars into production after 7 weeks, there will be 3 evaluations.

In 3 weeks time the car should be driving and have basic functionality (line following).

In 5 weeks they want to be sure that the cars have the correct functions to :

- Follow the white line.
- Stop and continue at each transverse white line.
- Signalization.

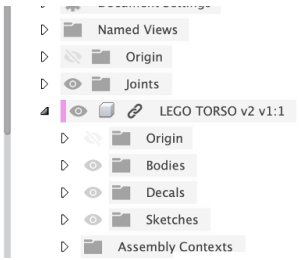
In 7 weeks a working prototype should be presented. This prototype will be tested for functionality and speed. The prototype may not contain any loose components, so the use of a breadboard is not allowed. At this time, all documentation should also have been provided.

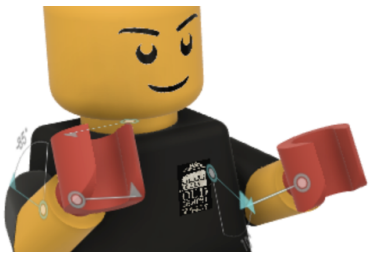
Github Page with Project Details

https://github.com/kverbeeck/IoT_Project_Line_Following_Car

YouTube Video Project Demo

https://www.youtube.com/watch?v=AkNlcWbXoIE





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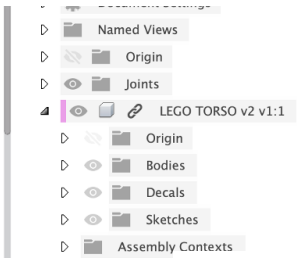

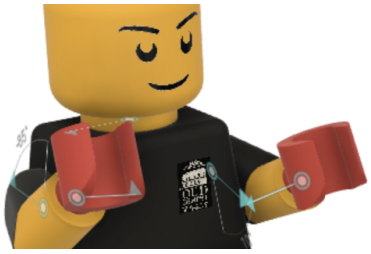

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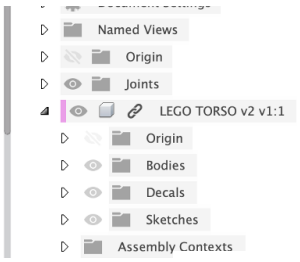
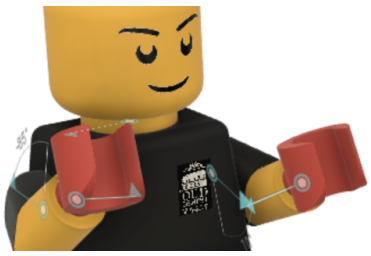
Required Hardware

Below the required hardware for this project, of course you are free to buy your components wherever you like.

	Item Name	Quantity	Price €	Item Description
1	LEGO 42093	1	39.99	Lego 42093 Technic Chevrolet Corvette ZR1
2	2 x L298N and 4 x DC-motors	1	12.99	KYYKA Motor Drive Controller (2x) for Arduino Dual H Bridge DC-steppermodule L298N with 4 DC-engines
3	2 x 18650 Battery	1	15.89	Battery Double Pack US18650VTC5A (KONION) - MURATA 18650
4	Mega 2560 Microcontroller Board	1	13.79	SUNFOUNDER Mega 2560 R3 ATmega2560 ATmega16U2 Microcontroller Board Compatibel met Arduino Genuino MEGA 2560
5	Servo HS-422	1	12.04	Hitec RCD 31422S HS-422 Deluxe Servo
6	Mini-Traffic Light	1	3.99	AZDelivery Led-lightmodule Creative DIY mini-traffic light 3,3-5 V 5 mm compatibel with Arduino!
7	Push-Button	1	7.99	RUNCCI-YUN Momentary Tactile Push Buttons, 12 x 12 x 7,3 mm, Micro Momentary push-buttons, 4-pins microswitches for Arduino, 80 pieces
8	Resistor-Set	1	8.99	AZDelivery Resistor-set 525 pieces resistors assortiment, 0 ohm -1 Mohm
9	Capacitors-Set	1	11.99	BOJACK 15 Wert 600 Stück Keramik kondensator 10pF 20pF 30pF 47pF 56pF 68pF 100pF 220pF 330pF 680pF 1nF 4.7nF 10nF 47nF 100nF Sortiments kit
10	TRCT5000	1	4.99	AZDelivery 3 x TRCT5000 IR infrared line-tracking module compatibel with Arduino
11	LED EL 5-7150WW	2	0.31	LED EL 5-7150WW LED, 5 mm, leaded, warm white, 7150 mcd, 50 °
12	LED EL SF 14RT	2	0.24	LED EL SF 14RT Super-Flux-LED, 7.6x7.6 mm, 70 °, red, 8660 mcd, 85 °





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Links to hardware

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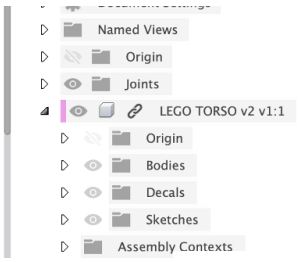

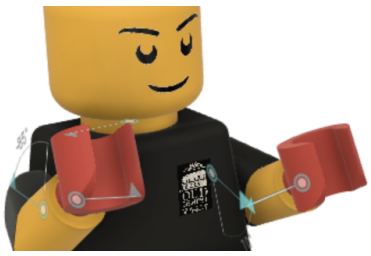

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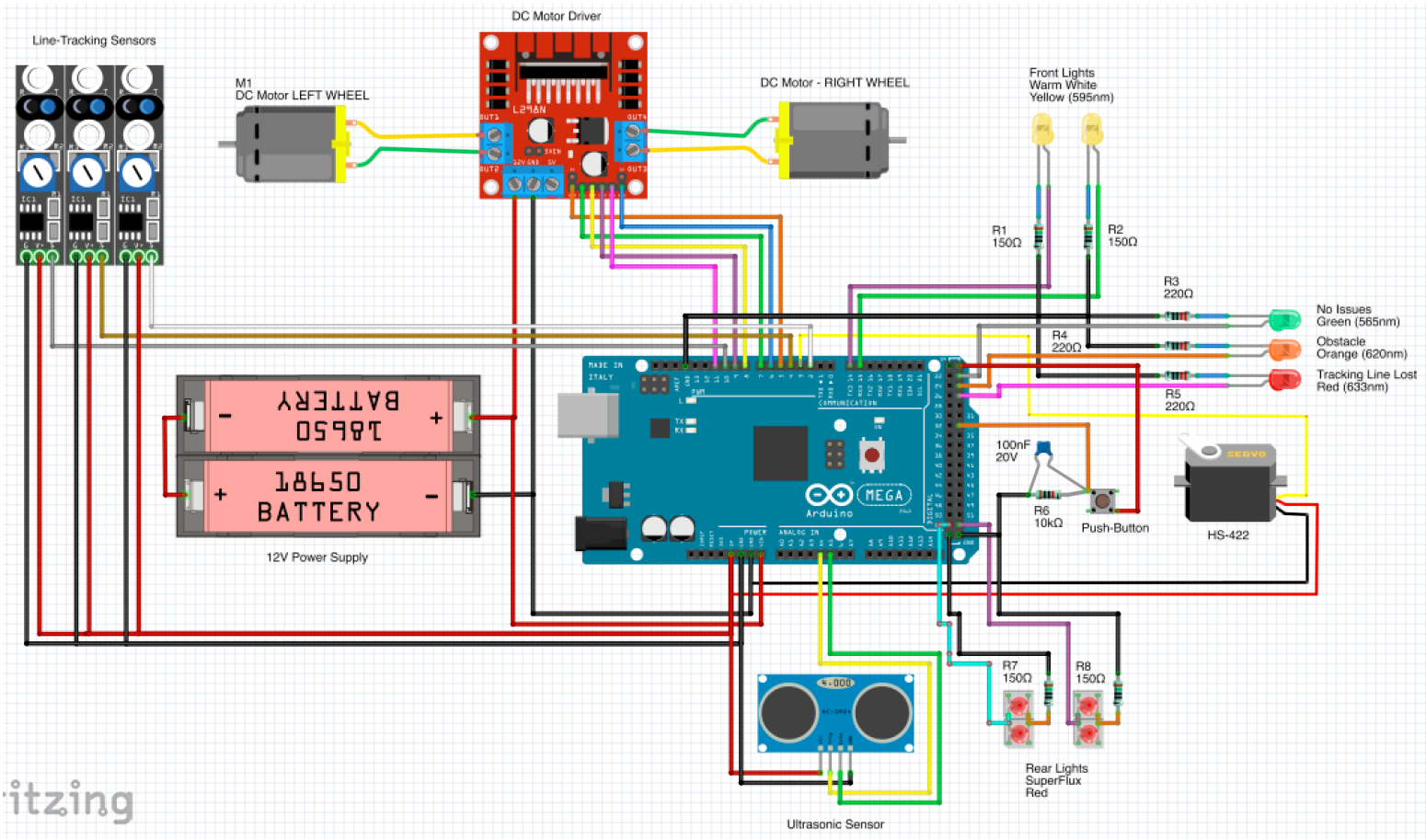
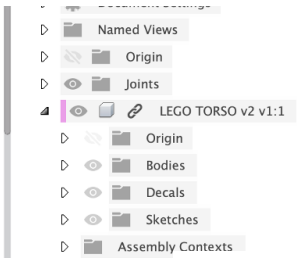
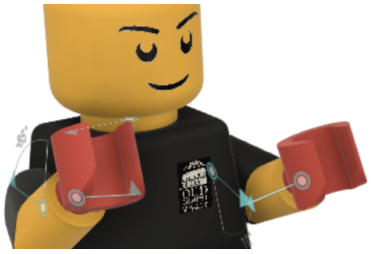
Schematics

Below the design for the electronics and their connections to the MEGA2560 Micro-Controller.







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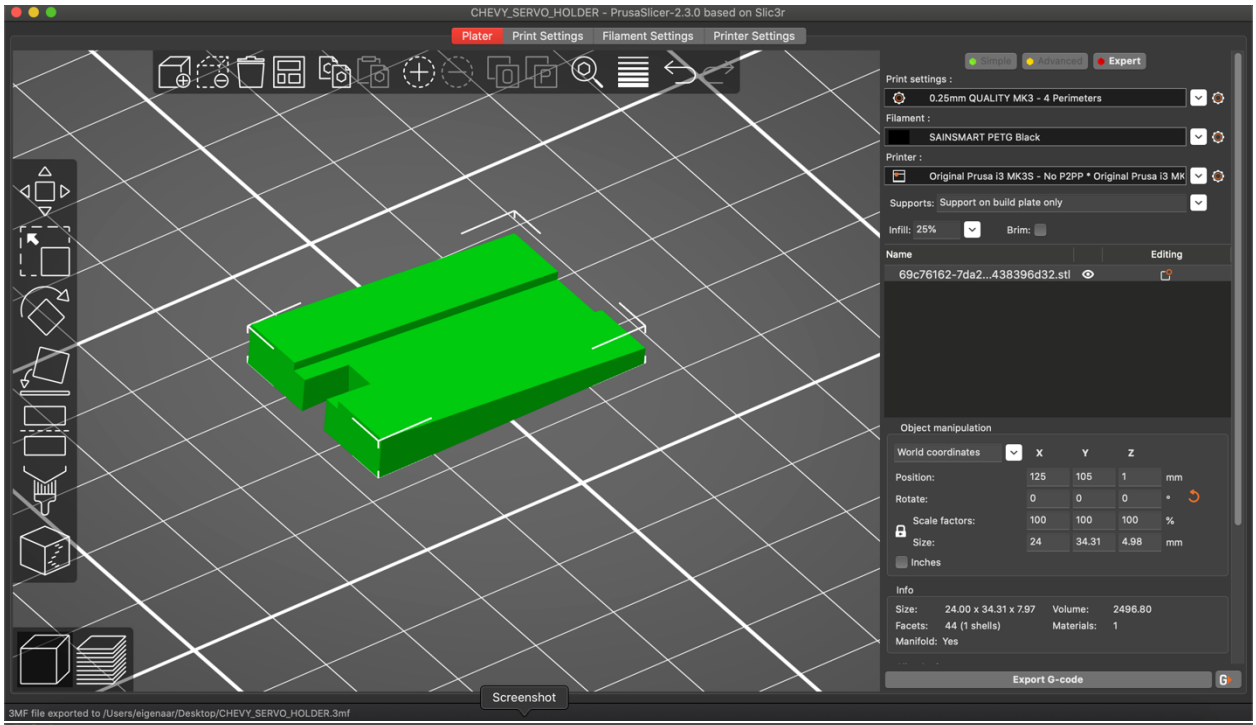
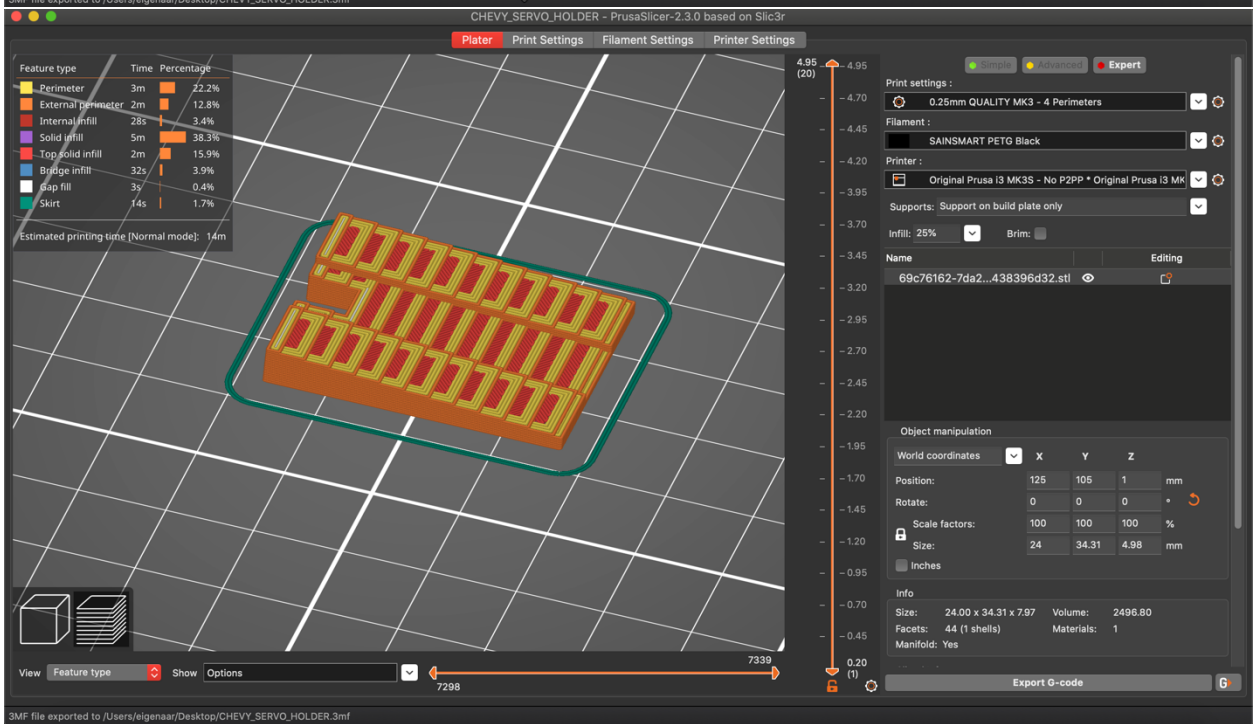
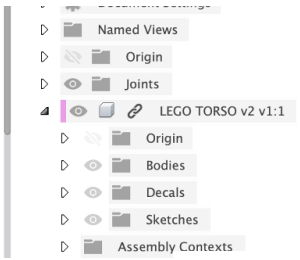
3D Printing

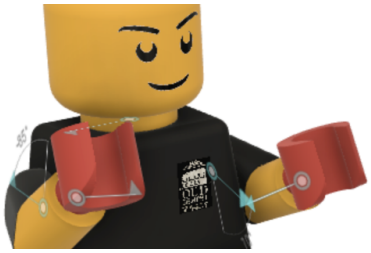
Following part should be printed to mount the HS-422 Servo into the car. See my Github page for more details.



Screenshot







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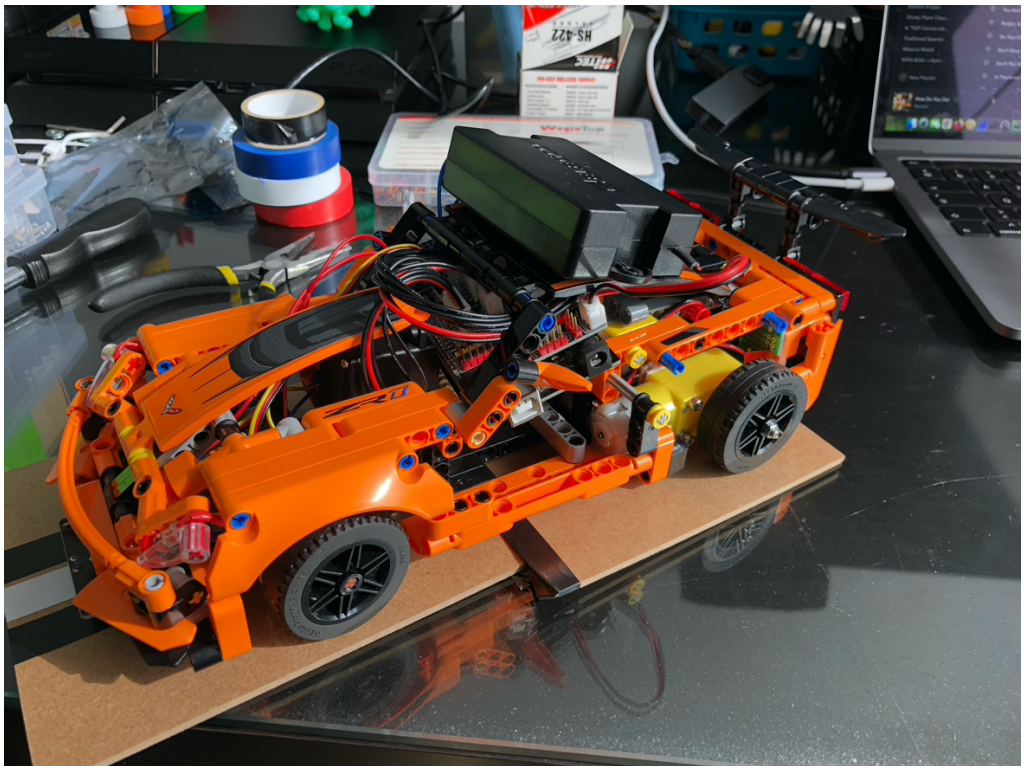
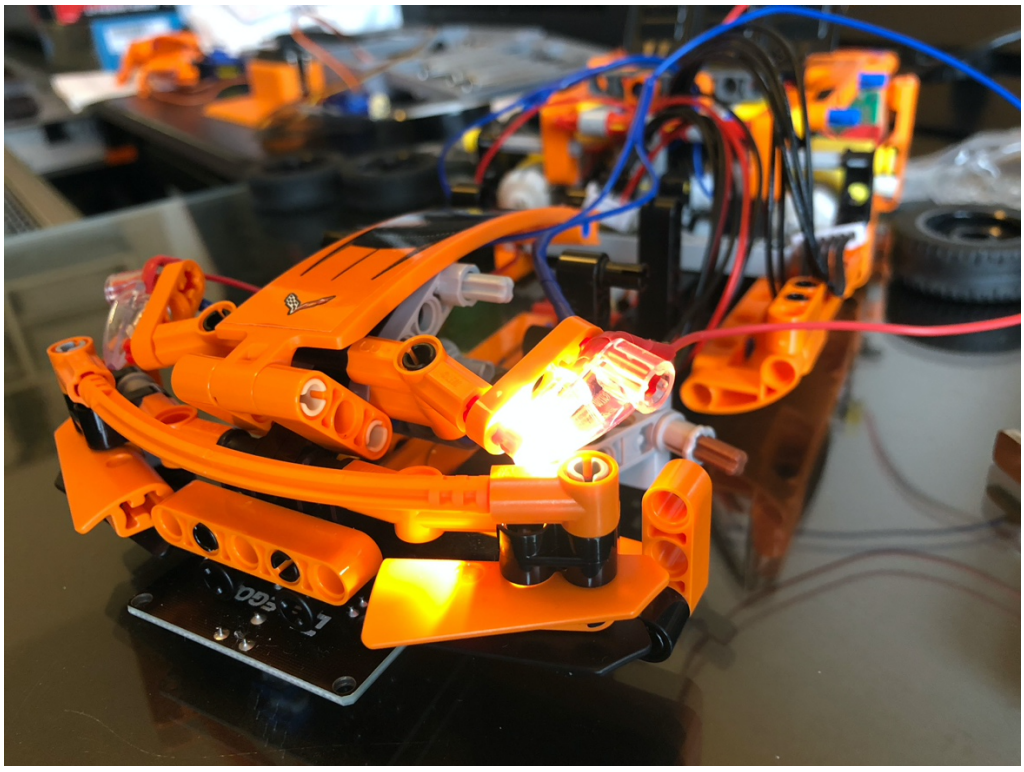
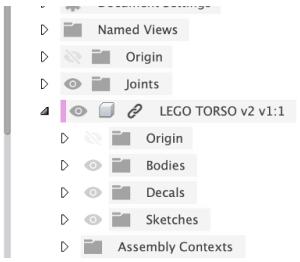
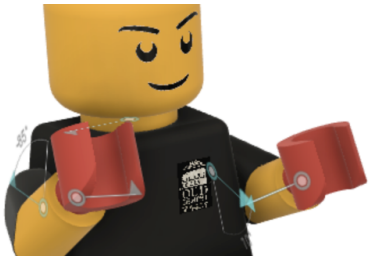
Pictures









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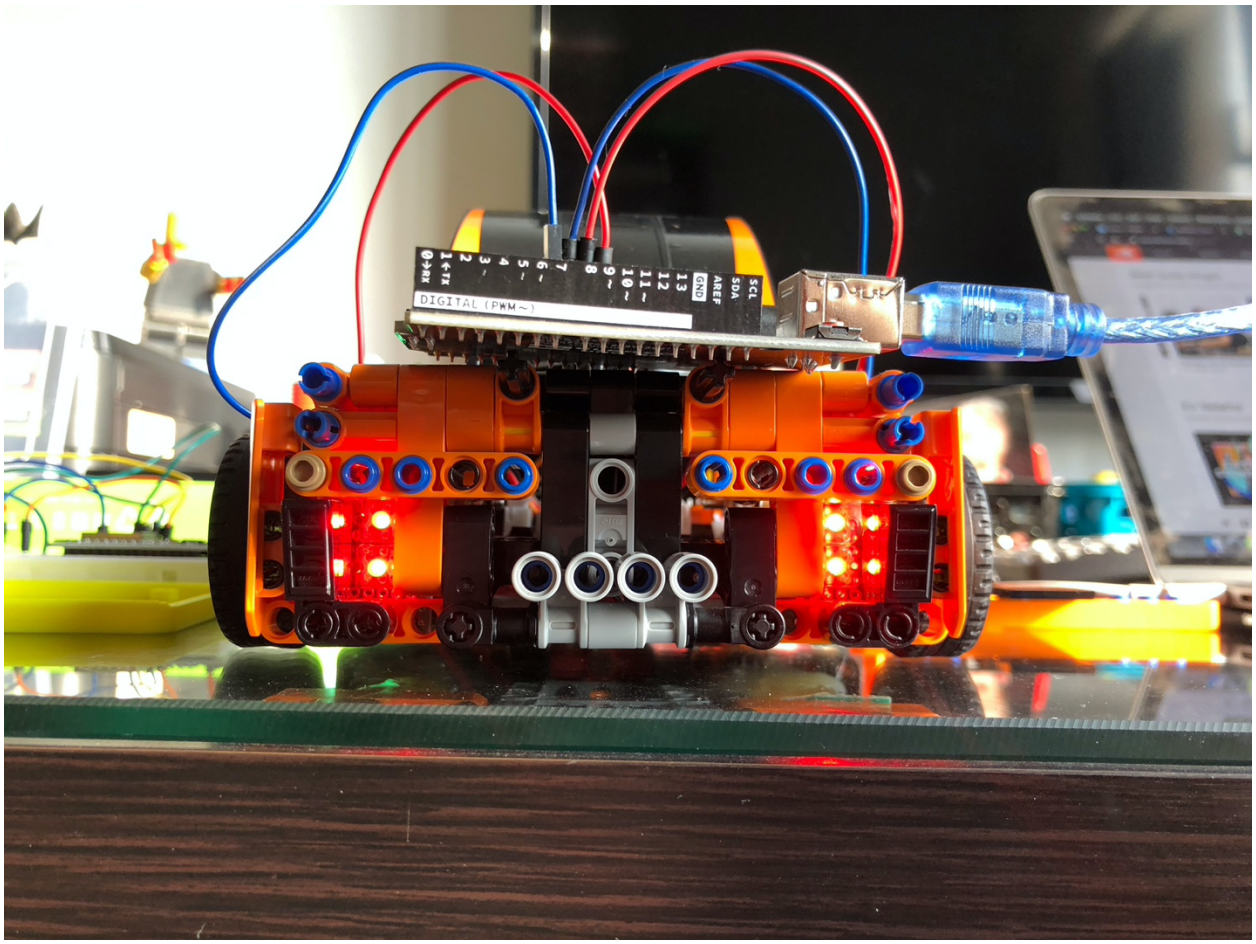

More pictures can be found on my Github page.
Video can be found on my YouTube Page.