



Assembling the DIY robotic car



Introducing the 5 Big Ideas in Artificial Intelligence using
Internet of Things in STEM education

T2.4 IoT Projects Design & Resources Development

AI4STEM IoT Projects Design & Resources Development Project: The DIY robotic car Assembling the DIY robotic car

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1.Assembling the DIY robotic car

1.1 Introduction

This document will present how the DIY robotic car can be assembled using the material included in the AI4STEM kit.

1.2 The Hardware

Figure 1 presents the basic electronic components that you need for creating the robotic car. In particular, you will need a BBC micro:bit microcontroller (1), a Kitronik Compact Motor Driver (2), a 3AA (or 4AA) battery holder (3), 2 DC gear motors (4) and 2 wheels (5).

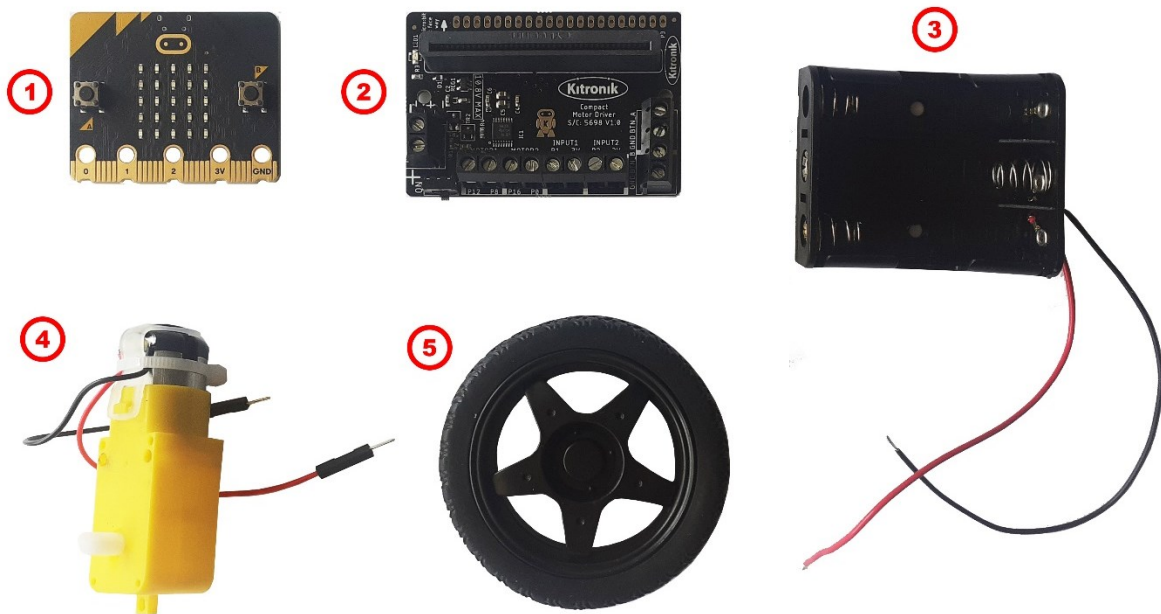


Figure 1: The electronic components needed for creating the robotic car

1.3 The chassis

The kit includes a 3D printed chassis to assist in the construction of the car. All of the component will be attached to either the top or bottom side of the chassis. The top side of the chassis is the one with the double-sided tape (Figure 2).



Figure 2: The two sides of the chassis

1.4 Attaching components to the bottom side of the chassis

Start the construction from the bottom side of the chassis. The components you will need are, the 2 DC gear motors **(1)**, the 2 Wheels **(2)**, the ball caster **(3)**, the 4 nuts **(4)**, the 4 30mm screws **(5)**, the 4 3D printed brackets/fasteners **(6)**, the 4 10mm screws **(7)**, and the 2 20mm spacers **(8)** (Figure 3).

Tip: you may also need a small screwdriver, preferably a magnetic one for better control.

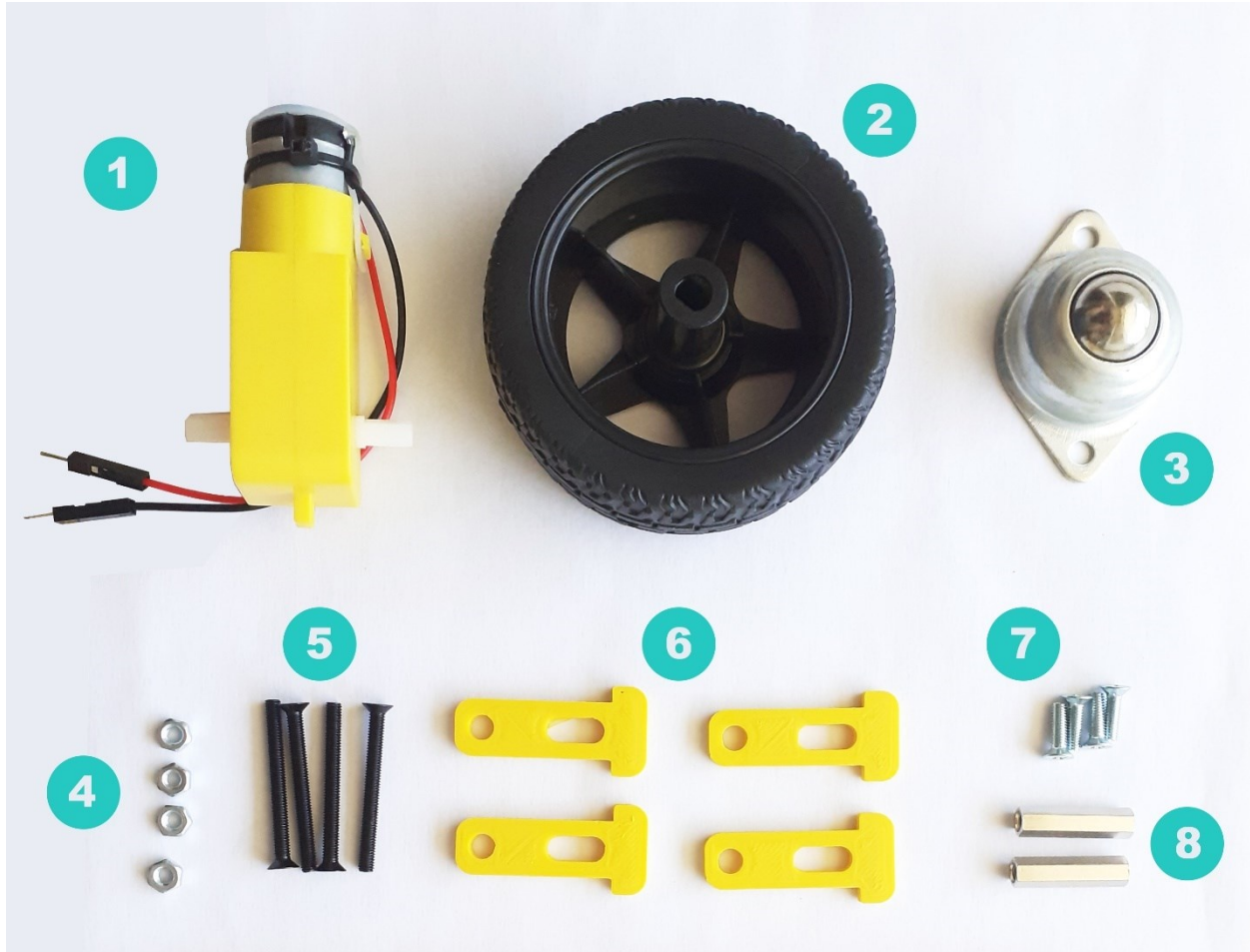


Figure 3: The component that will be attached to the bottom side of the chassis

Start by attaching the two DC gear motors. Figure 4 shows where the two DC gear motors and the four fasteners/brackets should be mounted.

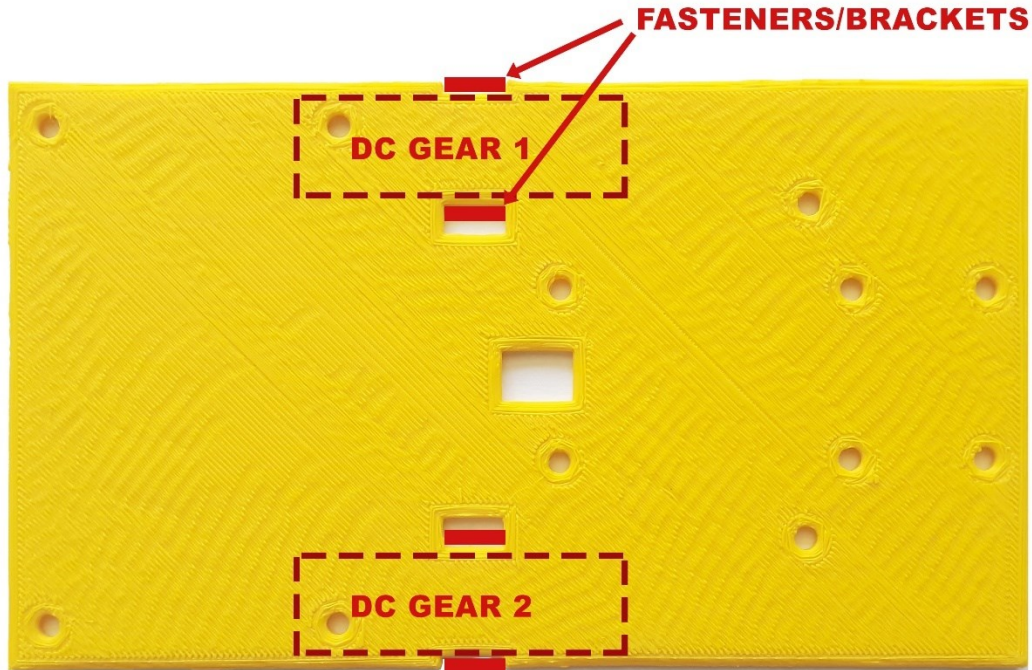


Figure 4: Diagram showing where the two DC gear motors and the 4 fasteners/brackets should be mounted

Before starting to bind the motors, take a close look at the two see-through holes that each of the motor has (Figure 5A). Using the brackets (two for each motor) (Figure 5B), and the 2 30mm screws, the motors will be mounted on the chassis.

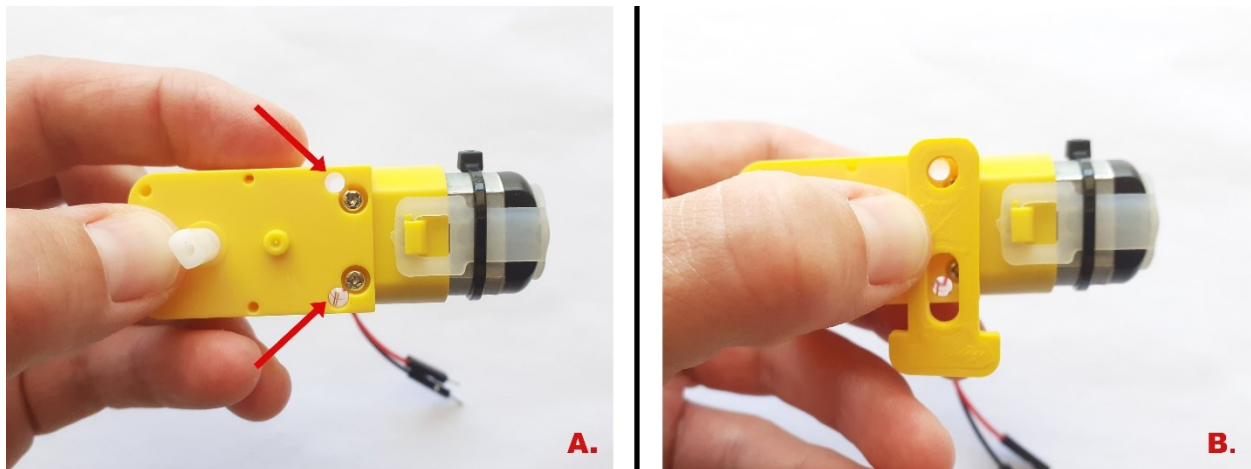


Figure 5: A. The see-through holes on the DC gear motor; B. Demonstration of where the fasteners/brackets should be placed

Place the two fasteners/brackets as shown in Figure 6A, and then firmly bind the DC gear motor by using the two 30cm screws and the two nuts (Figure 6B).

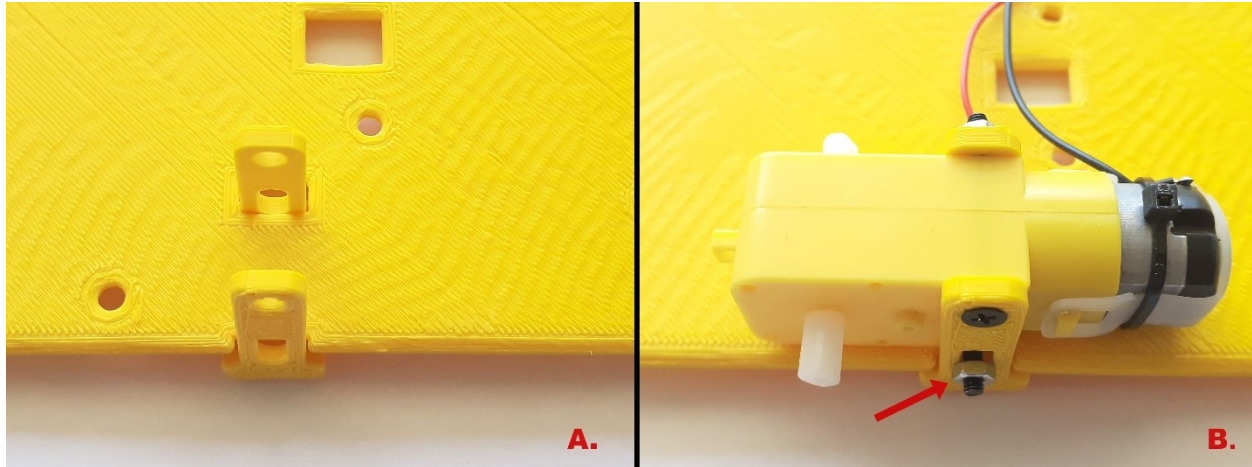


Figure 6: A. Placing the two fasteners/brackets on the chassis; B. Binding the DC gear motor using the fasteners, the two 30cm screws and the two nuts

Note: The best practice is to tighten both nuts from the interior part. However, this might be a little tricky for the nut that is closer to the surface of the chassis. If you have difficulty, tie the nut from the outer part, as indicated in Figure 6B. Just make sure that this nut does not interfere with the movement of the wheel.

Repeat the same process for the second DC gear motor. After placing both motors the car should look like Figure 7.

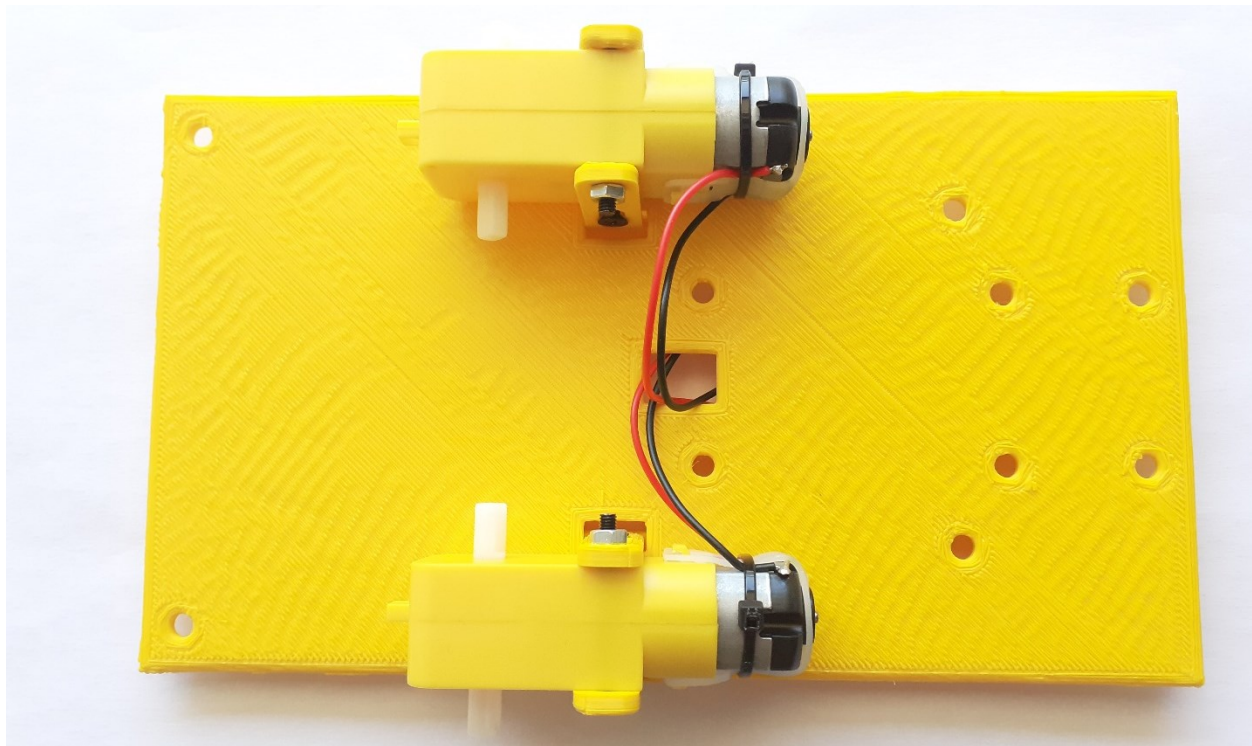


Figure 7: The DIY car after binding both DC gear motors

The next step is to clip the two wheels. To do that, just clip each wheel to the external shaft of each DC gear motor (Figure 8).

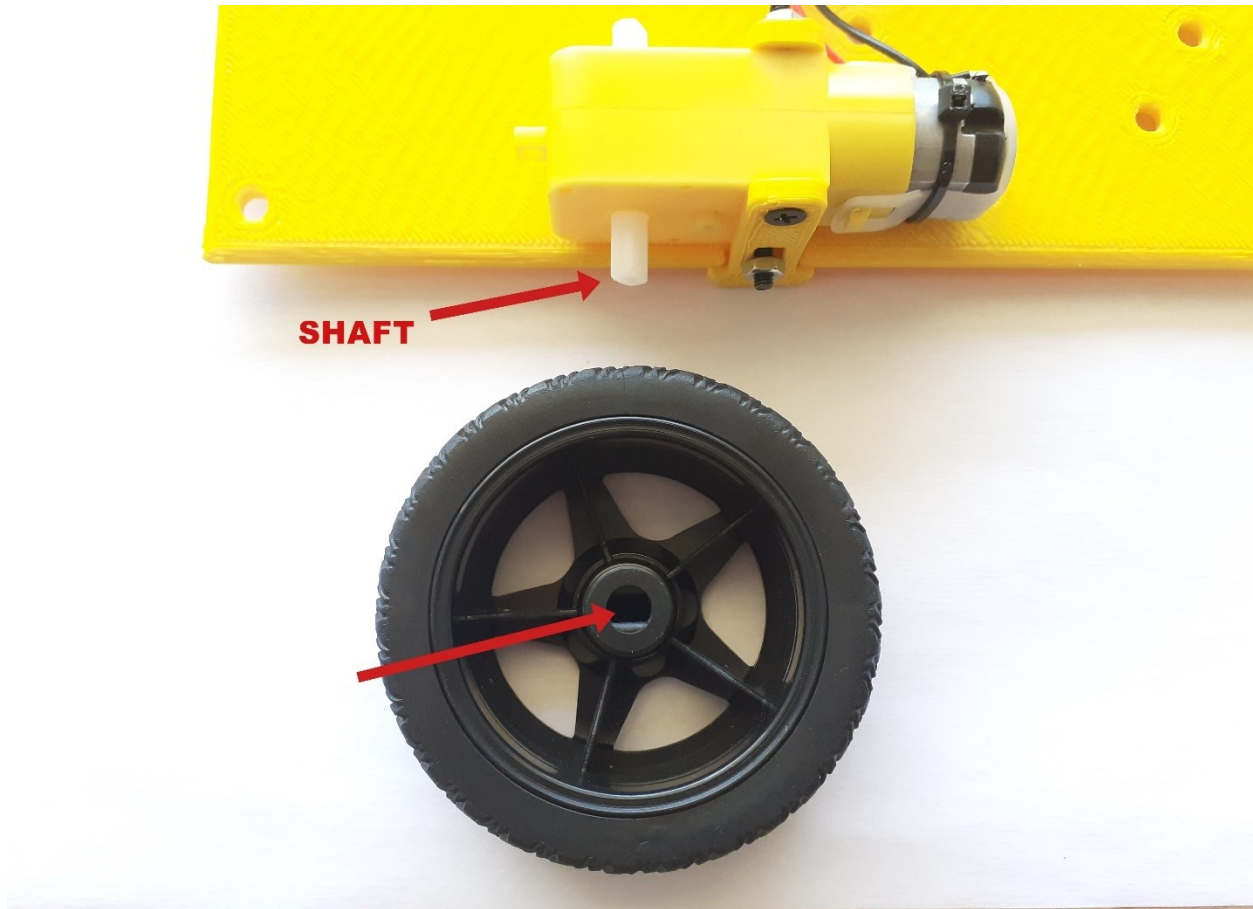


Figure 8: How to clip the wheel to the DC gear motor

Note: After the wheels have been fitted, try turning them manually to ensure that the nuts do not block their movement.

The next step is to mount the ball caster. The ball caster will act as the rear wheel of the car. Apart from the ball caster, you will also need the two 20mm spacers and the 4 10mm screws. Figure 9 shows where the caster will be mounted.

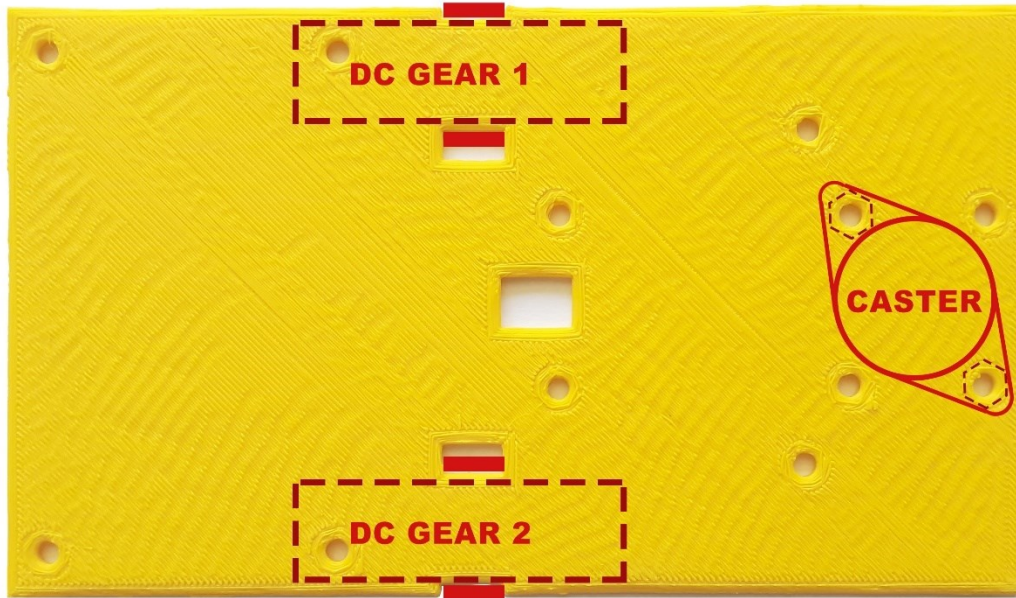


Figure 9: Diagram showing where the ball caster should be mounted

You can either bind the spacers on the chassis and then mount the caster, or bind the spacers on the caster and the mount it on the chassis (Figure 10).

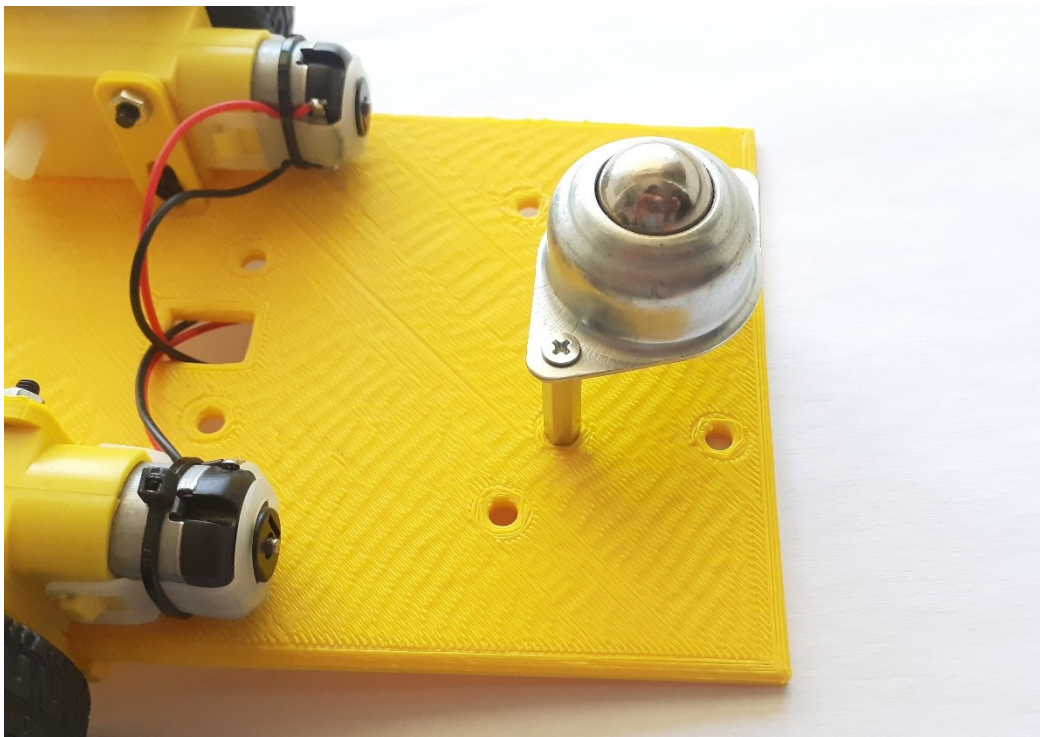


Figure 10: Mounting the ball caster on the chassis

Figure 11 and 12 show how the car should look like after placing the ball caster.

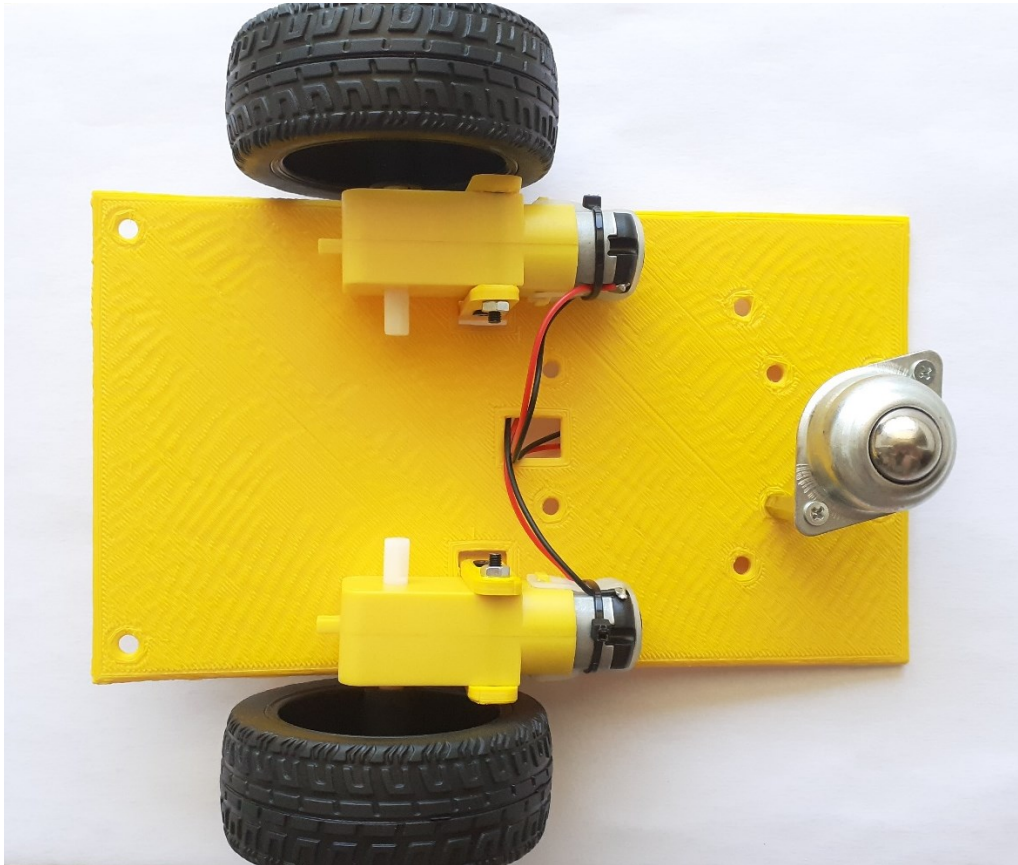


Figure 11: The DIY robotic car after placing the last part at the bottom side of the chassis

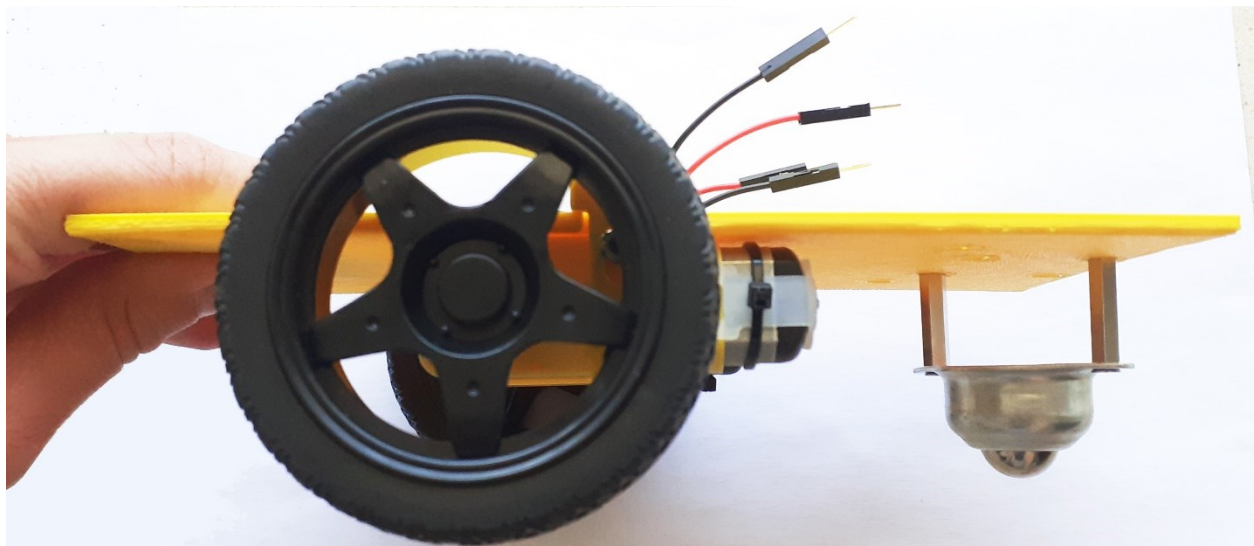


Figure 12: The DIY robotic car after placing all the components at the bottom side of the chassis

1.5 Attaching components to the top side of the chassis

Now it's time to assemble the top side of the chassis. The components that you need are: the 3AA battery holder (1), the Compact Motor Driver (2), the 2 M-F spacers (3), the 2 10mm screws (4) and the two nuts (5) (Figure 13).

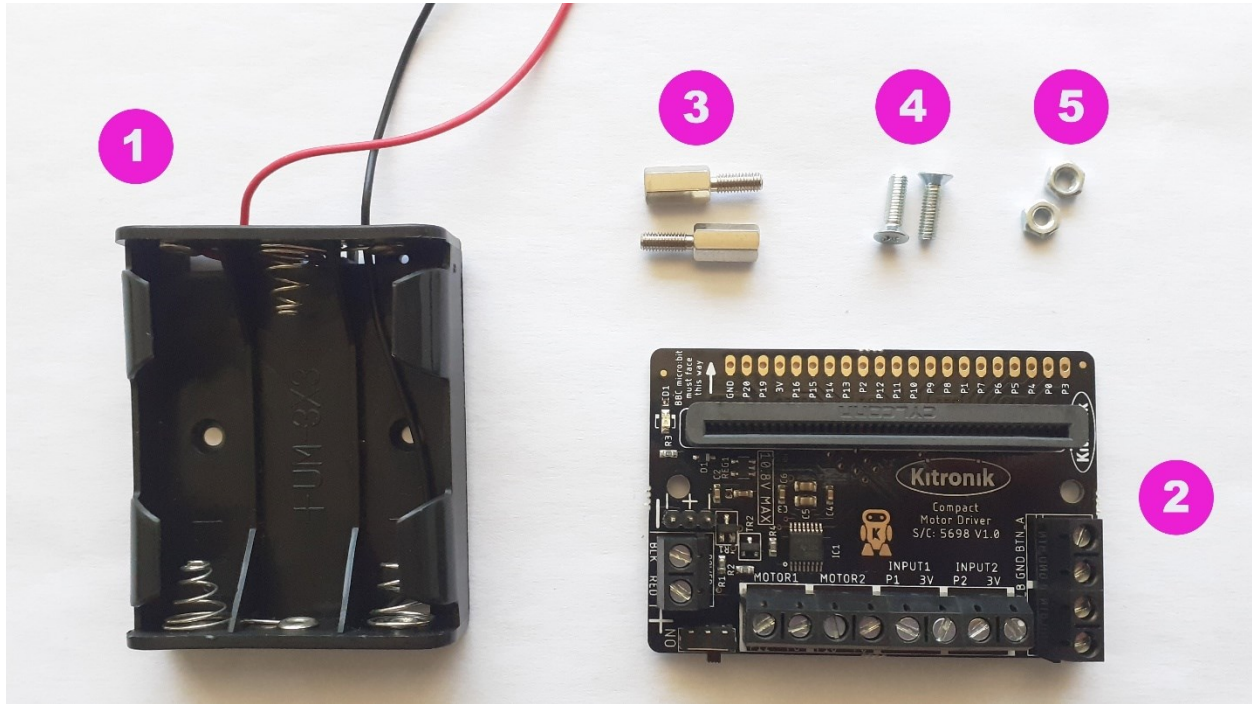


Figure 13: The component that will be attached to the top side of the chassis

The first component to be attached is the Compact motor driver. Figure 14 shows where this component should be mounted.

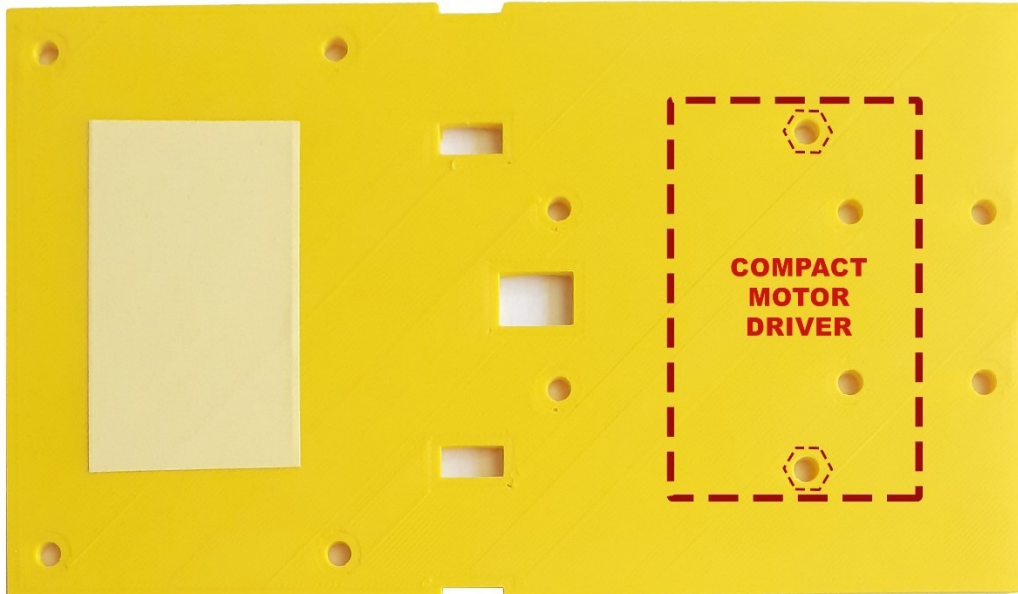


Figure 14: Diagram showing where the Compact motor driver should be attached

First, bind the two F-M spacers on the chassis as shown in Figure 15, using the two nuts.

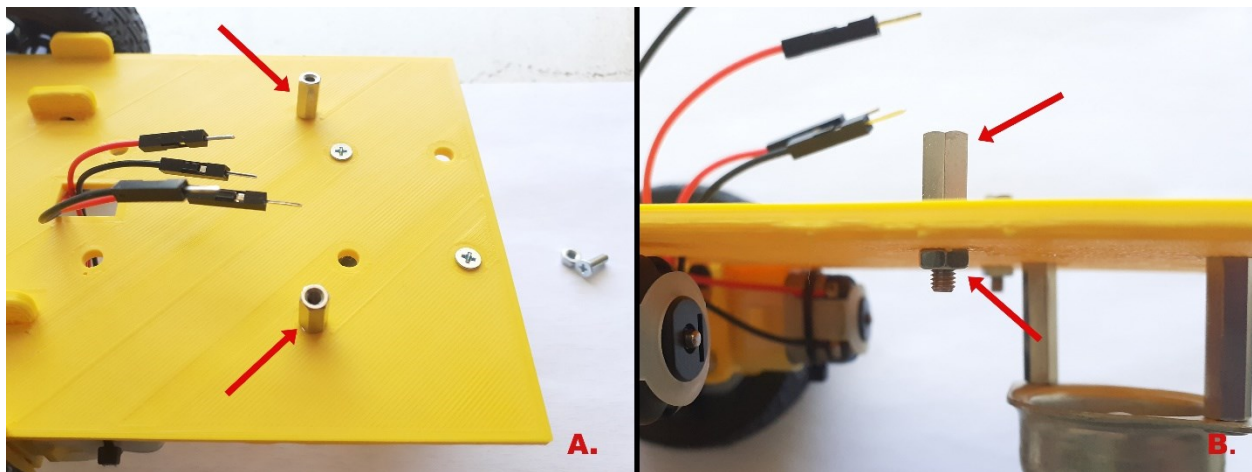


Figure 15: A. The two spacers on the top side of the chassis; B. The way that spacers are attached to the chassis

Next, bind the Compact motor driver on top of the spacers using the two 10mm screws (Figure 16).

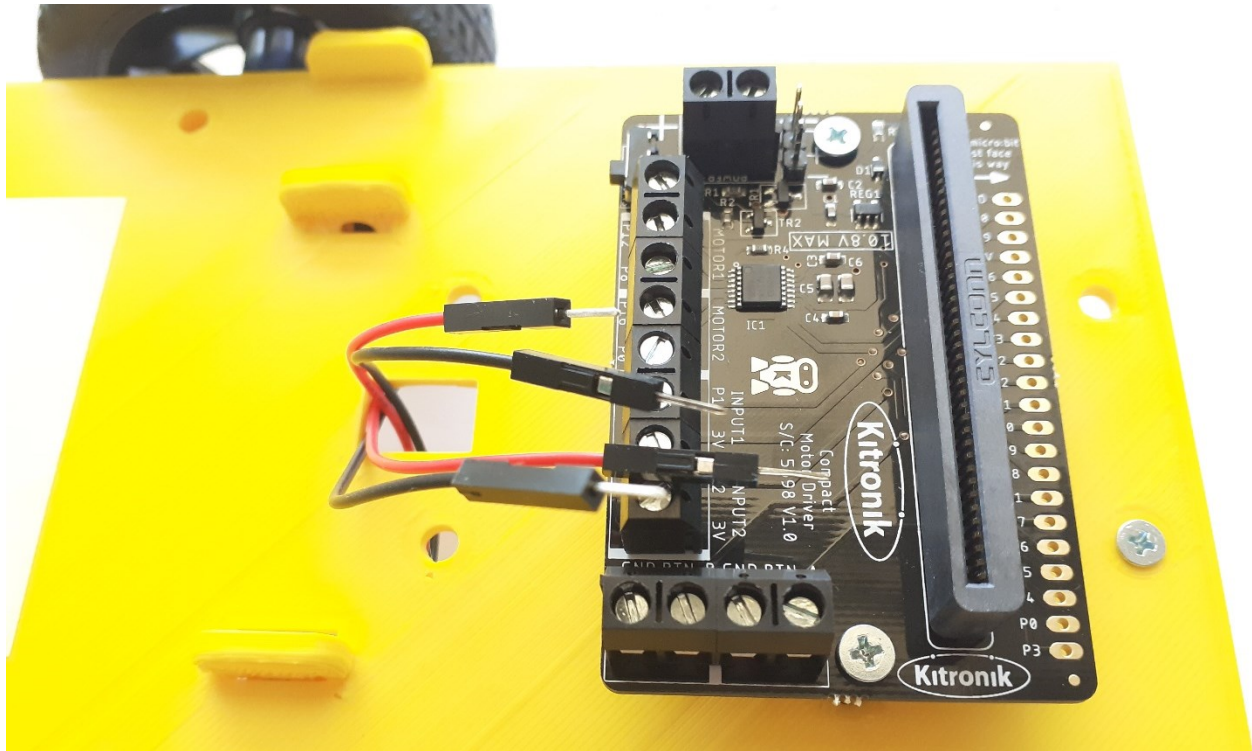


Figure 16: Attaching the Compact motor driver on the spacers.

The final step is to attach the battery holder. Simply peel off the top of the double-sided tape (Figure 17A) and stick the battery holder in place (Figure 17B).

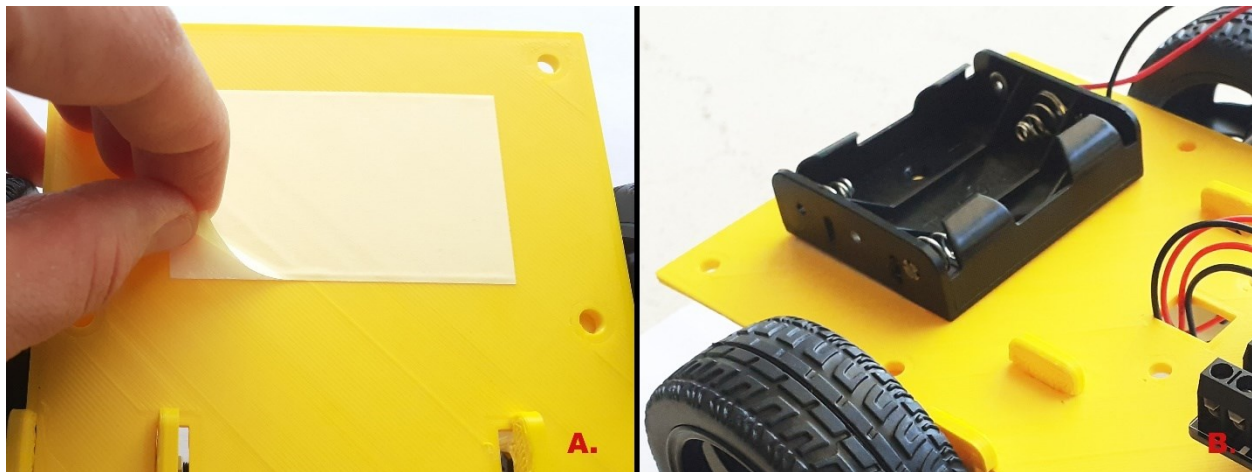


Figure 17: A. Peeling off the top of the double-sided tape; B. Sticking the battery holder in place

Figure 18 shows how the robotic car should look like after placing all the components on the top side of the chassis.

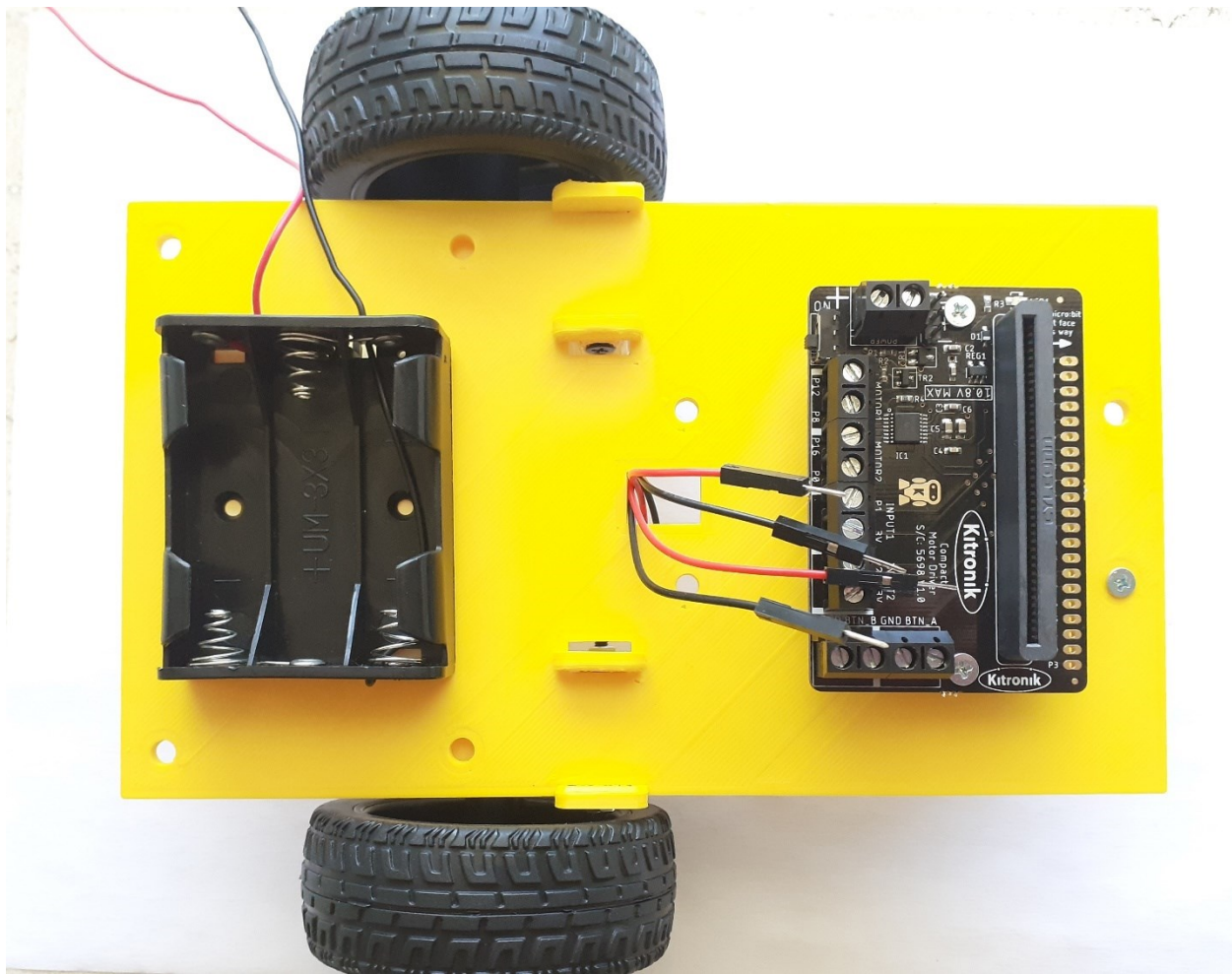


Figure 18: The robotic car after attaching all the components to the top side of the chassis

The very last part is the circuit.

1.6 The circuit

Figures 19, 20 and 21 show a diagram and some indicative pictures of the circuit. To connect the battery holder to the Compact motor driver you need to: connect the power (+) of the battery holder to the power terminal of the motor driver (1) and the ground (-) to the ground of the motor driver (2). For this purpose, you will need a small screwdriver in order to loosen and tighten the respective connectors. Then you need to connect the two DC gear motors to the Compact motor driver. Again, by using a small screwdriver connect one of the pins of DC motor 1 to the P12 terminal (3) and the other to the P8 terminal (4). Repeat the same process for DC motor 2 by connecting one pin to P0 terminal (5) and the other to P16 terminal (6).

Note: the pins of the DC gear motor have no polarity. So, keep in mind that you might need to switch the wires of one of the DC gear motors (for instance, to switch the wires that are connected to P0 and P16 terminals) if the wheels are spinning in the opposite direction.

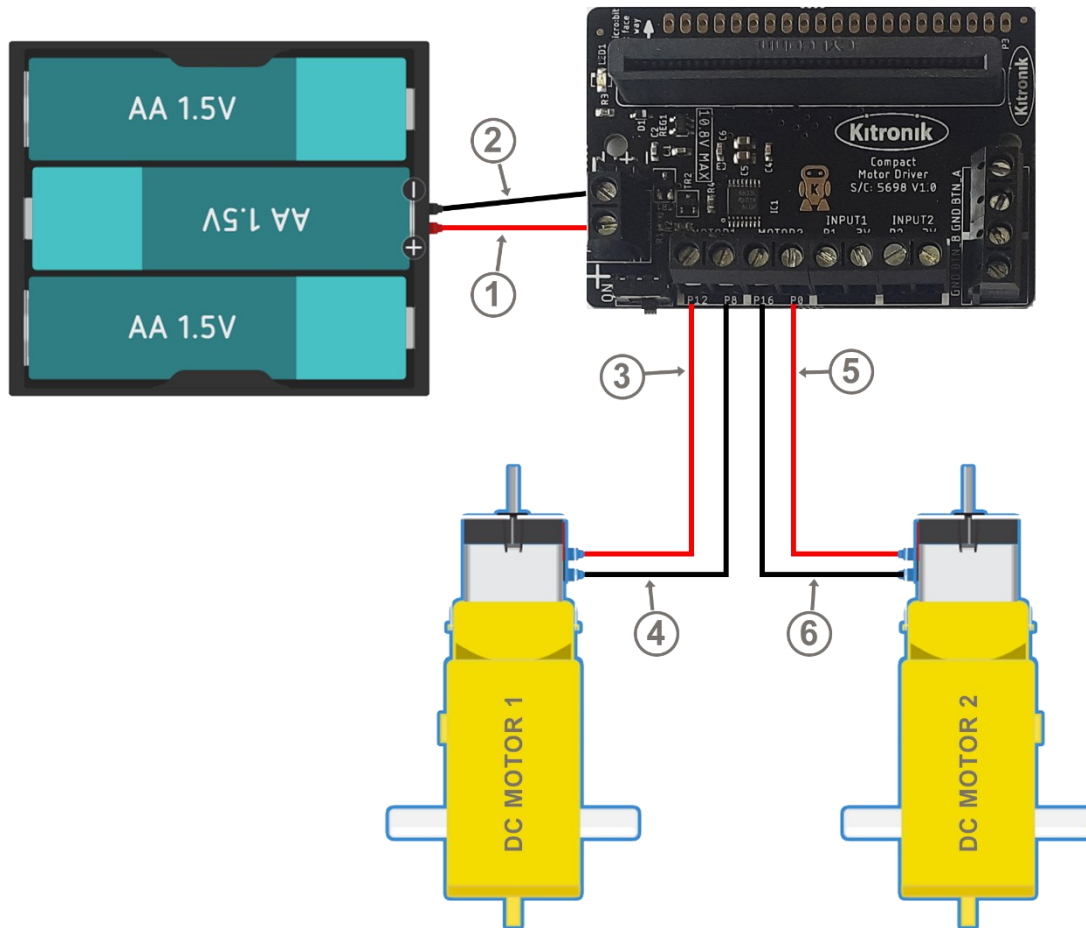


Figure 19: The basic circuit of the robotic car

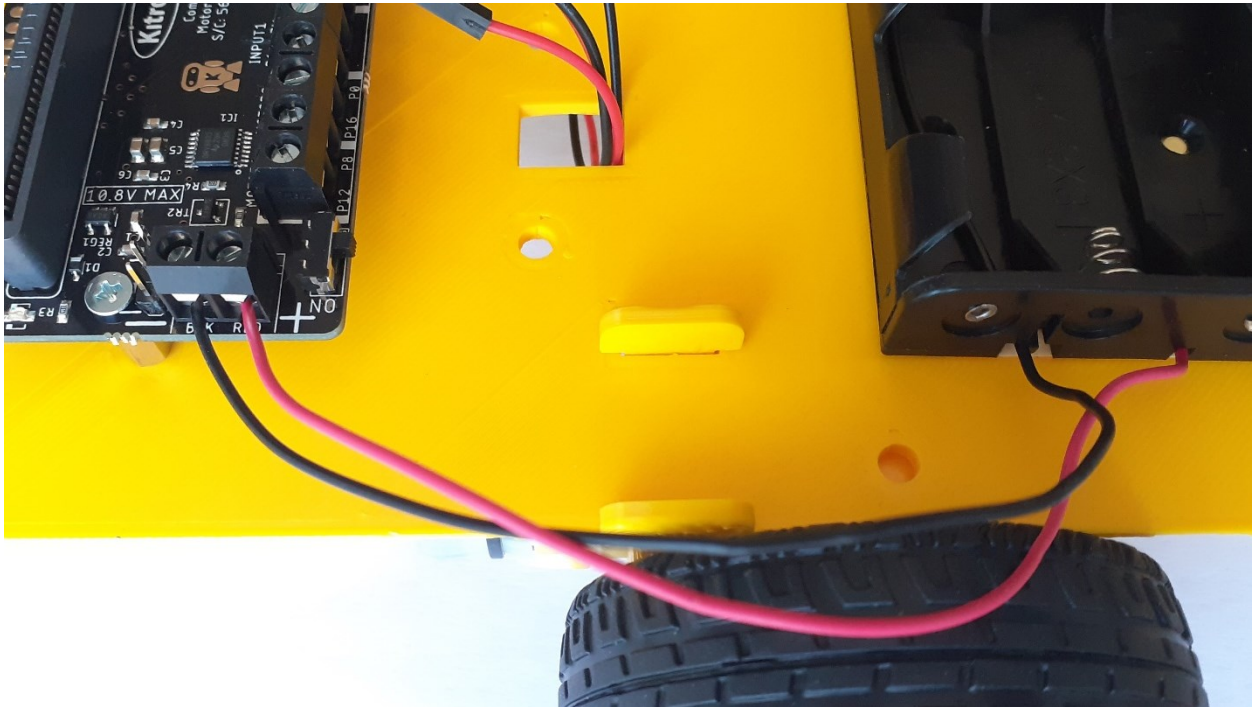


Figure 20: Connecting the battery holder to the Compact motor driver



Figure 21: Connecting the two DC gear motors to the Compact motor driver

Figure 22 shows how the robotic car should look like after finishing the circuit making process.

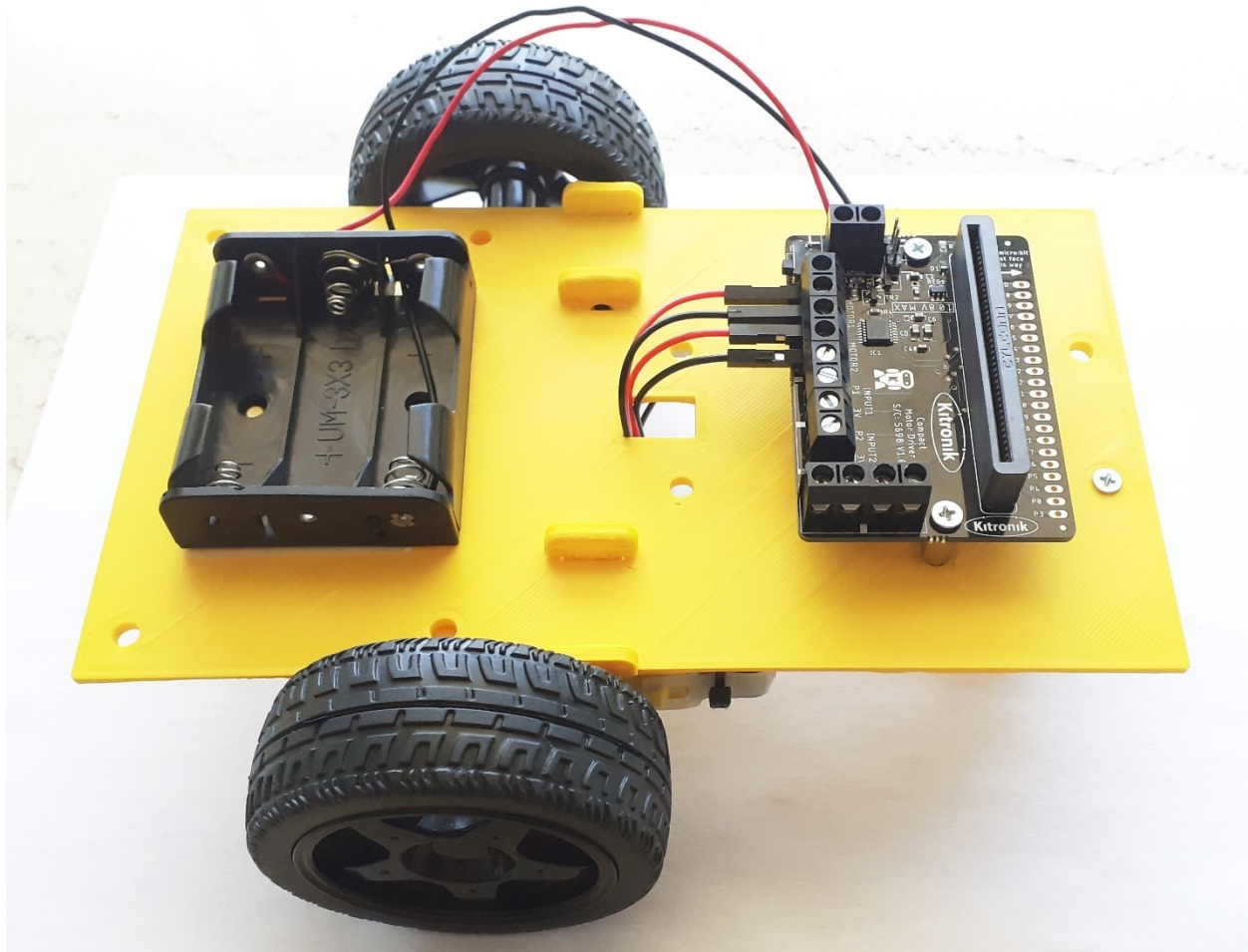


Figure 22: The robotic car after finishing the circuit making process

To use it with the micro:bit, simply clip the micro:bit onto the compact motor driver (Figure 23) and start programming using the Makecode software.

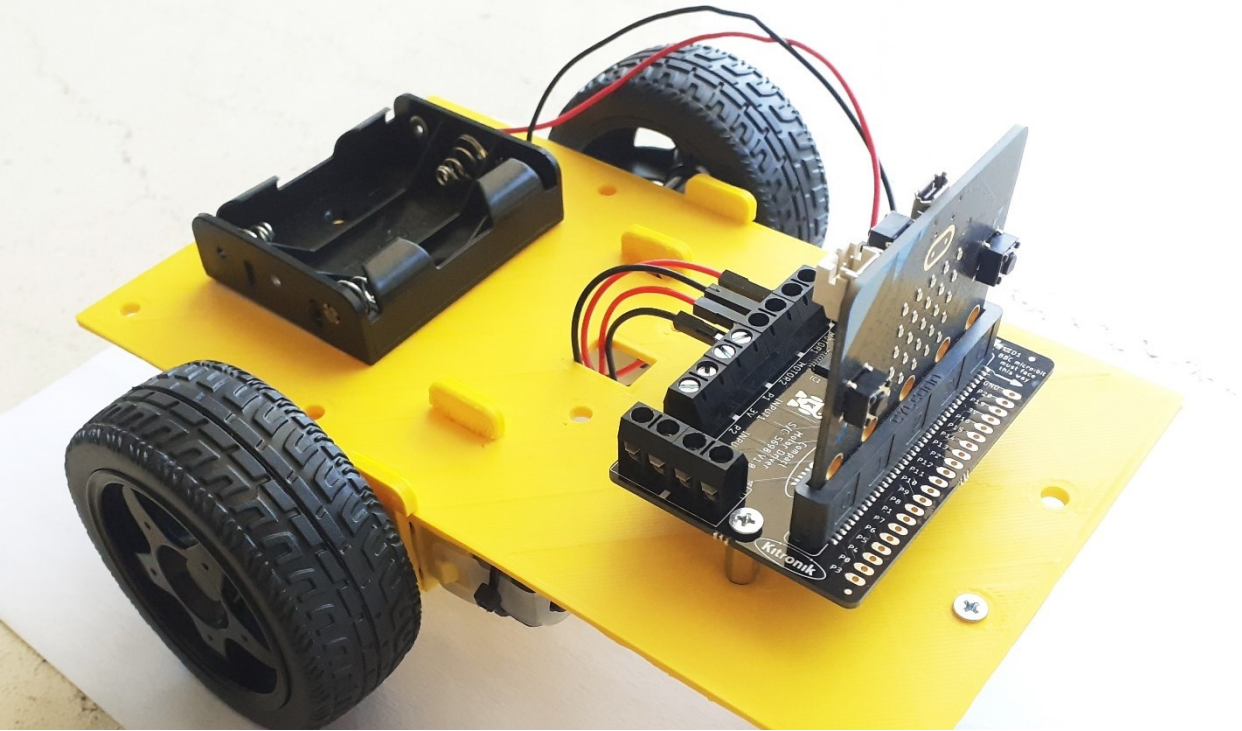


Figure 23: Clipping the microbit on the Compact motor driver

Important notes:

Note 1: To use the robotic car, you must insert 3AA batteries into the battery holder.

Note 2: To conserve power, the Compact motor driver has an on/off switch (Figure 24). When you are ready to set the car in motion, make sure the switch is on.

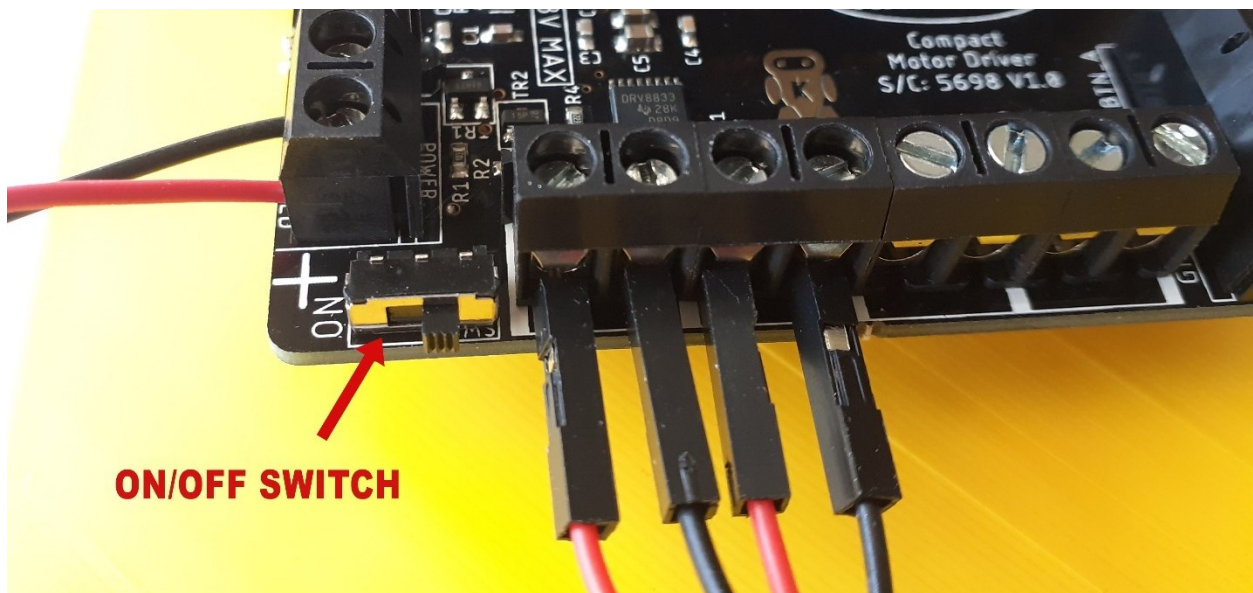


Figure 24: The on/off switch