ARTIE: Artificial Intelligence in Education - challenges and opportunities of the new era: development of a new curriculum, guide for educators and online course for students
Project co-funded by European Union under Erasmus+ Programme, 2020-1-HR01-KA201-077800

TITLE: Building a robot - 2 options

LEARNING SCENARIO		
School:	***Duration (minutes):***	135
Teacher:	***Students' age:***	13-14

Essential Question:	How to assemble a robot - ARTIEbot

Topics:

- Assembling a robot

Aims:

- To learn how to assemble a robot

Outcomes:

- Successfully assembling a robot - ARTIEbot

Work forms:

- work in pairs, group work

Methods:

- presentation, talk, discussion, interactive exercise

ARTICULATION

Course of action (duration in minutes)

INTRODUCTION

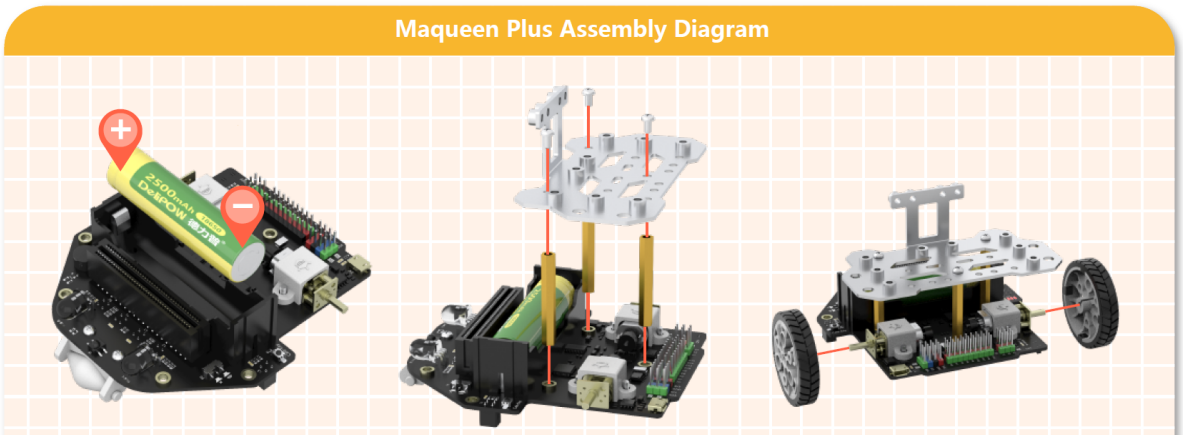
A part of this curriculum is related to real physical device with AI capabilities. Croatian Robotic Association has developed a small affordable mobile robot platform to implement programing knowledge from previous lessons.

Defining the goal of the lesson:
Assembling our robot - ARTIEbot.

ARTIE: Artificial Intelligence in Education - challenges and opportunities of the new era:
development of a new curriculum, guide for educators and online course for students
Project co-funded by European Union under Erasmus+ Programme, 2020-1-HR01-KA201-077800

MAIN PART

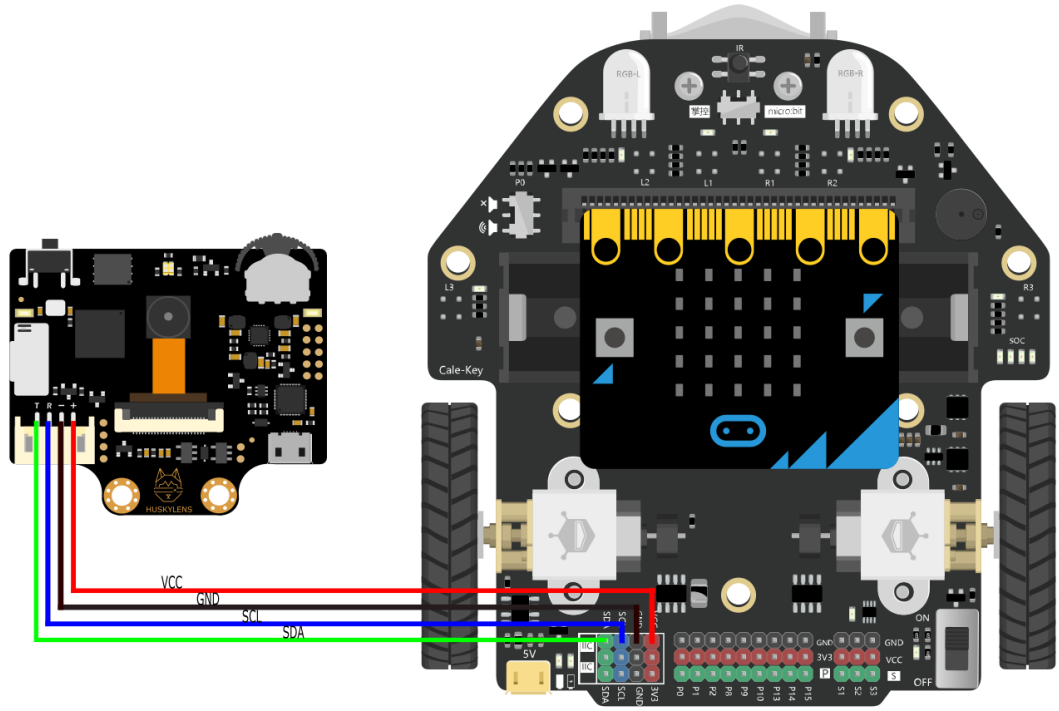
Option 1a - Assembling the Maqueen Plus robot V1 (recommended for beginners)



1) insert the 18650 battery 2) install the bracket 3) attach the wheels

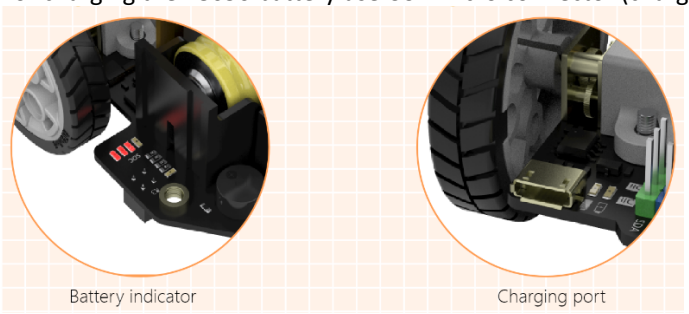
4) Mount the HuskyLens camera 5) Place the micro:bit board in the slot

ARTIE: Artificial Intelligence in Education - challenges and opportunities of the new era:
development of a new curriculum, guide for educators and online course for students
Project co-funded by European Union under Erasmus+ Programme, 2020-1-HR01-KA201-077800



6) Connect Maqueen Plus board with HuskyLens camera

For charging the 18650 battery use USB micro connector (charging port) on rear side of the robot:



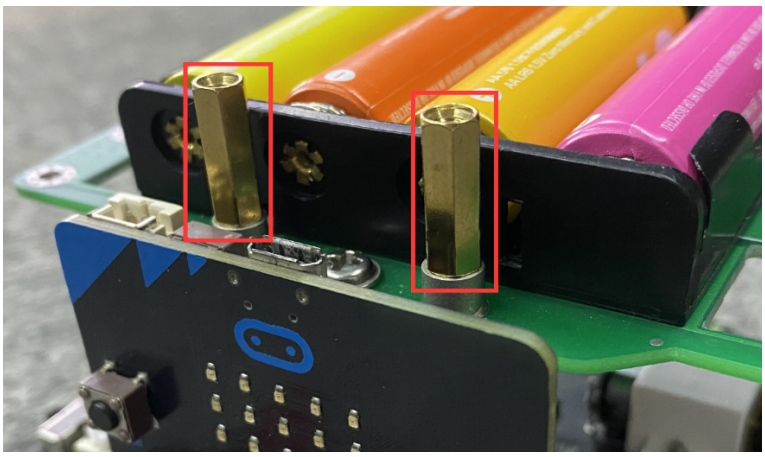
When the battery is fully charged, all LEDs will be on. The LEDs will turn off one by one as the power gradually decreases. If all lights go out, the battery needs to be recharged. Use your phone charger and connect it to charging port.

Keep in mind that charging port is for charging only. For programing Maqueen Plus robot - use USB micro connector on micro:bit.

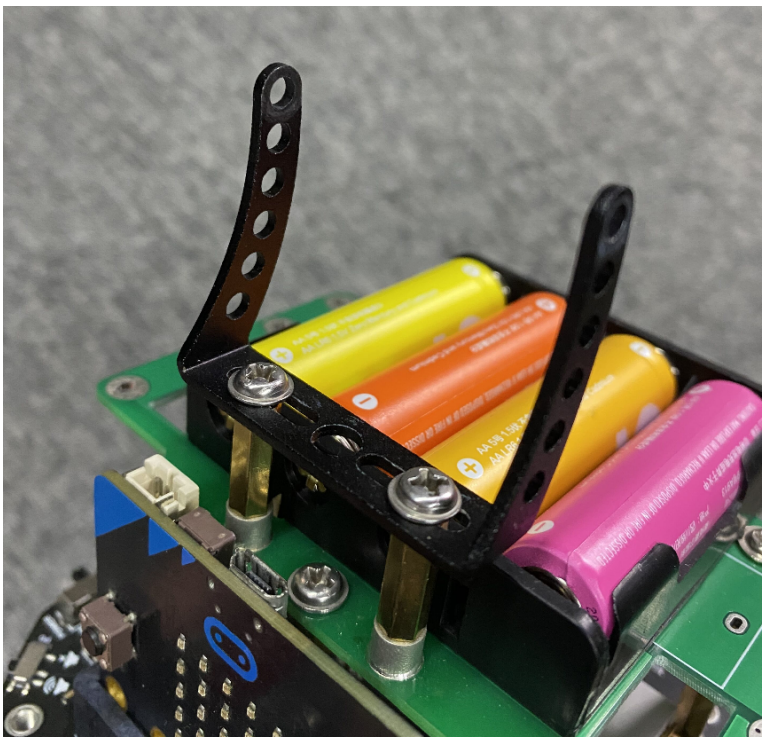
Option 1b - Assembling the Maqueen Plus robot V2 (also recommended for beginners)
The Maqueen plus V2 robot comes preassembled, and you simply need to mount a HuskyLens camera on it

1. Install the two copper pillars delivered by the product in the position as shown in the figure.

ARTIE: Artificial Intelligence in Education - challenges and opportunities of the new era:
development of a new curriculum, guide for educators and online course for students
Project co-funded by European Union under Erasmus+ Programme, 2020-1-HR01-KA201-077800

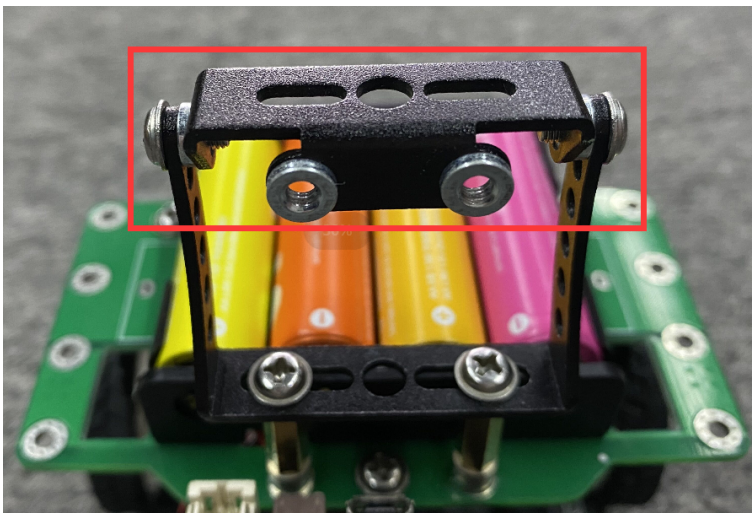


2. Fix the arc-shaped bracket (the bracket and mounting screws are provided with the HuskyLens product) on the copper column with screws.

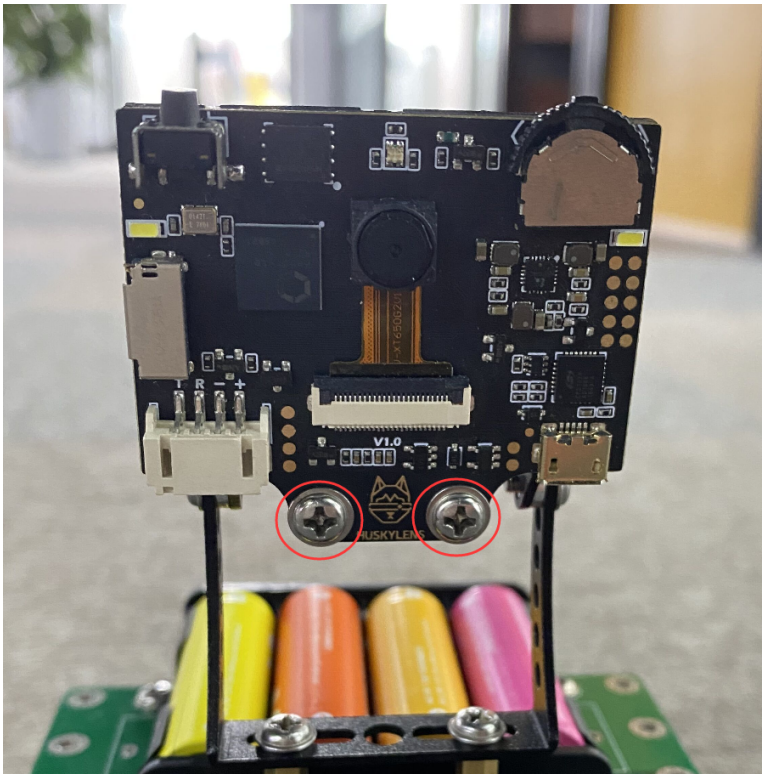


3. Install the other bracket (the bracket and mounting screws are provided with the HuskyLens product)

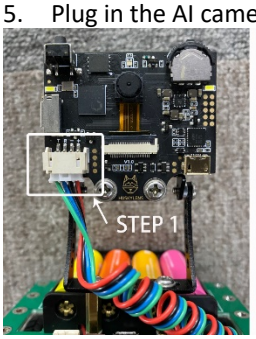
ARTIE: Artificial Intelligence in Education - challenges and opportunities of the new era:
development of a new curriculum, guide for educators and online course for students
Project co-funded by European Union under Erasmus+ Programme, 2020-1-HR01-KA201-077800

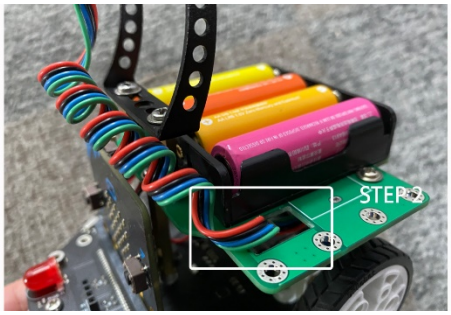


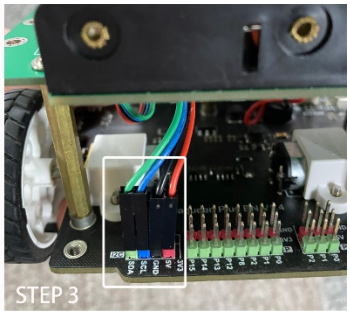
4. Install HuskyLens AI camera



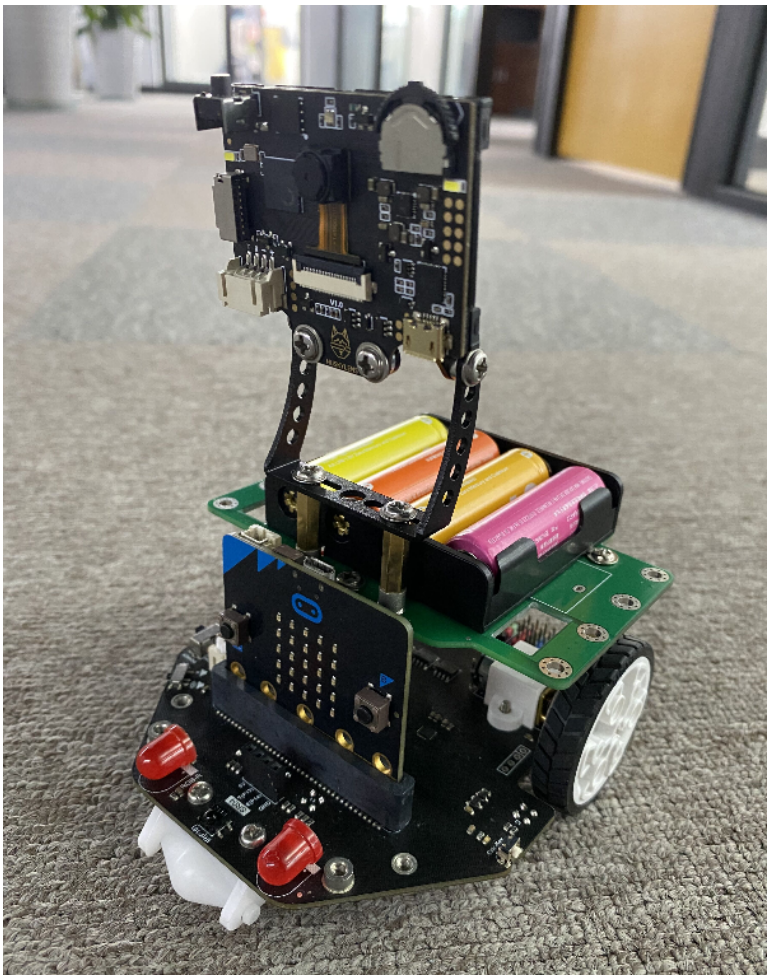
5. Plug in the AI camera connection







6. Installation done.



Option 2 - Assembling the Arduino robot (for experienced DIY users only)

Bill of material (BOM)

- 1 x Smart car robot kit for Arduino
  https://botland.store/chassis-for-robots/7283-chassis-rectangle-2wd-2-wheel-robot-chassis-with-dc-motor-drive-5904422335649.html
- 1 x Jumpers set
  https://botland.store/various-wires/1022-connecting-cables-male-male-65pcs.html
- 1 x Additional battery holder (4 x AA)
  https://botland.store/battery-holders/173-battery-holder-4-x-aa-r6-5904422329389.html
- Various screws and nuts
  https://botland.store/screws-and-nuts/637-screws-nuts-and-washers-set-330pcs-5410329304478.html
- 1 x Arduino UNO (original or clone)
  -https://store.arduino.cc/collections/boards/products/arduino-uno-rev3
  -https://botland.store/arduino-compatible-boards-dfrobot/2683-dfrduino-uno-v3-compatible-with-arduino.html
- 1 x Arduino motor shield R3

ARTIE: Artificial Intelligence in Education - challenges and opportunities of the new era: development of a new curriculum, guide for educators and online course for students
Project co-funded by European Union under Erasmus+ Programme, 2020-1-HR01-KA201-077800

https://store.arduino.cc/collections/shields/products/arduino-motor-shield-rev3

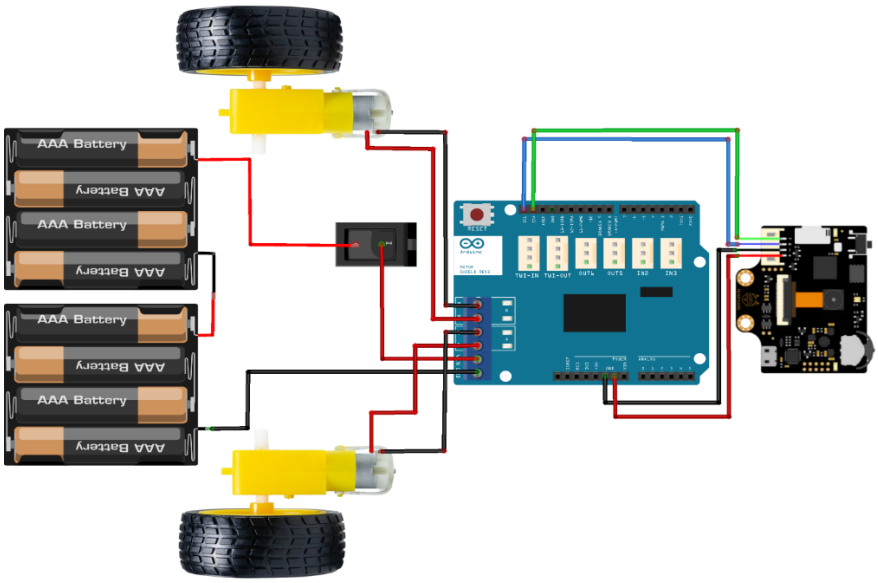
- 1 x HuskyLens AI camera https://store.arduino.cc/collections/dfrobot/products/gravity-huskylens-ai-machine-vision-sensor
- 8 x AA Batteries (try to use rechargeable ones)
- Cable ties (if you want to fix some cables and battery holder)

Tools required

- Screwdrivers (you will need one with slot head and one with Philips head)
- Soldering iron and solder
- Insulation tape or heat shrink tubes
- Cutting pliers

Step 1) Scheme

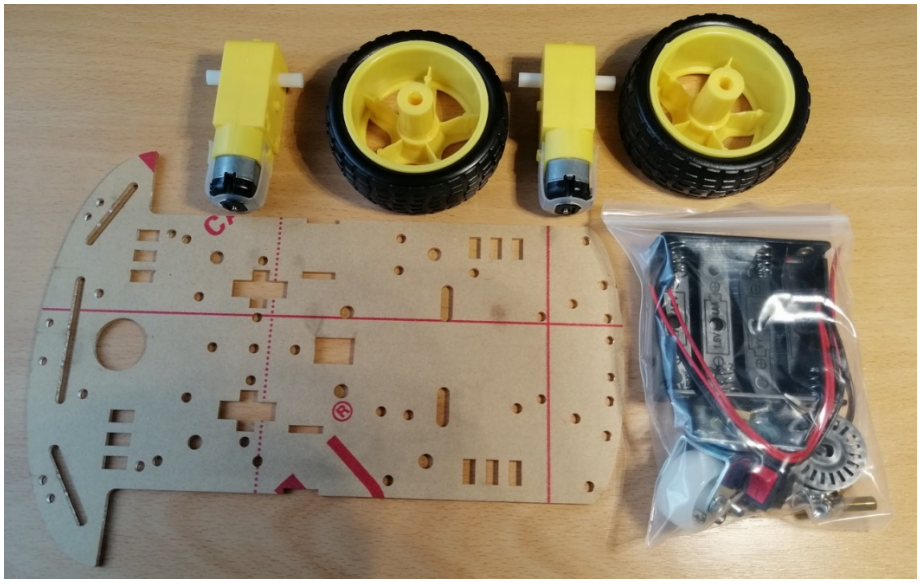
Here is a wiring scheme. Notice that we will use double battery holder in serial connection so that each battery in holder is connected (+ to - and - to +). 8 AA batteries should provide more voltage to power input and prevent Arduino or HuskyLens resets when motors start to work. You can also use 3 x 18650 type batteries in serial connection.



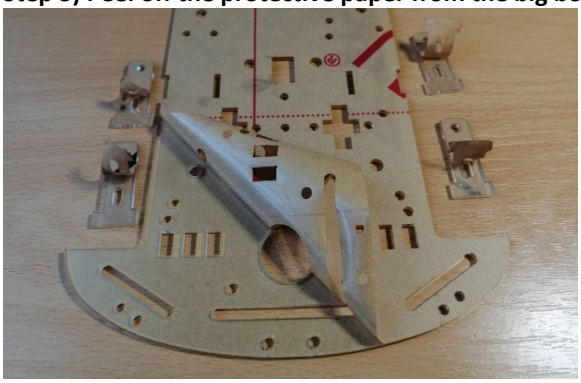
Take some time to analyse the components and wiring.

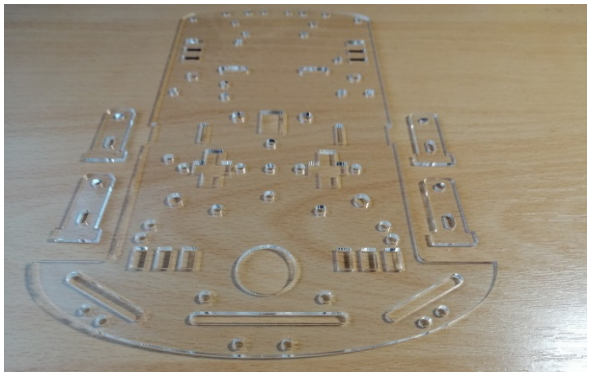
Step 2) Smart car robot kit for Arduino - open the plastic bag with parts

ARTIE: Artificial Intelligence in Education - challenges and opportunities of the new era: development of a new curriculum, guide for educators and online course for students
Project co-funded by European Union under Erasmus+ Programme, 2020-1-HR01-KA201-077800

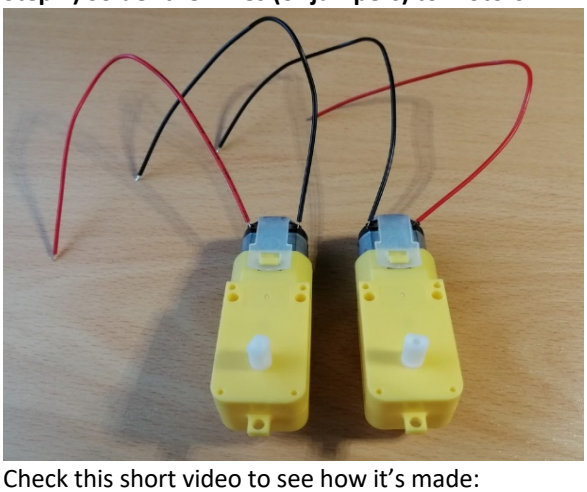


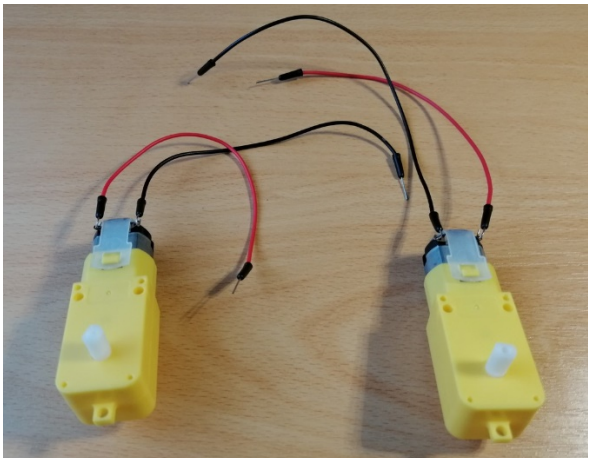
Step 3) Peel off the protective paper from the big board and motor brackets





Step 4) Solder the wires (or jumpers) to motors

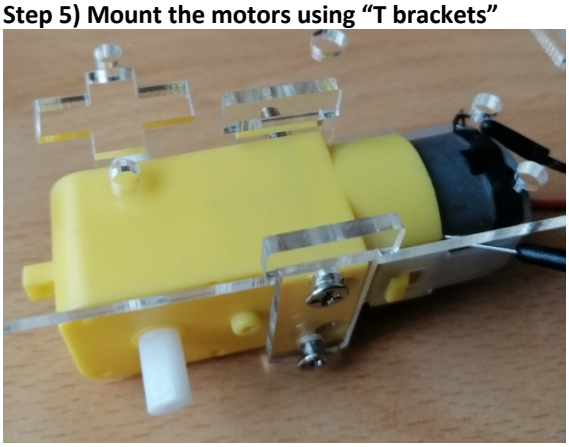
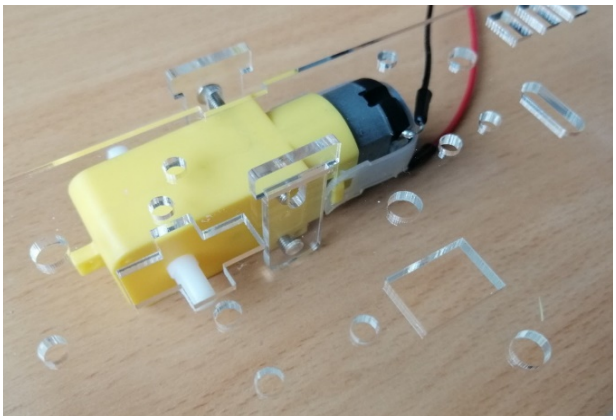


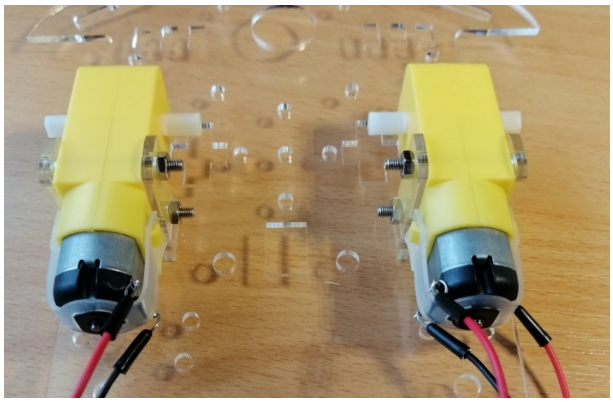


Check this short video to see how it's made:
https://www.youtube.com/watch?v=xSWKnnvGWBs
Ask your teacher or parent to help you with it if you don't have previous experience or tools.

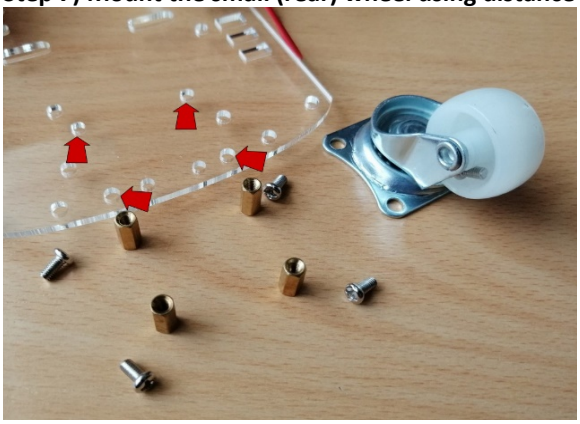
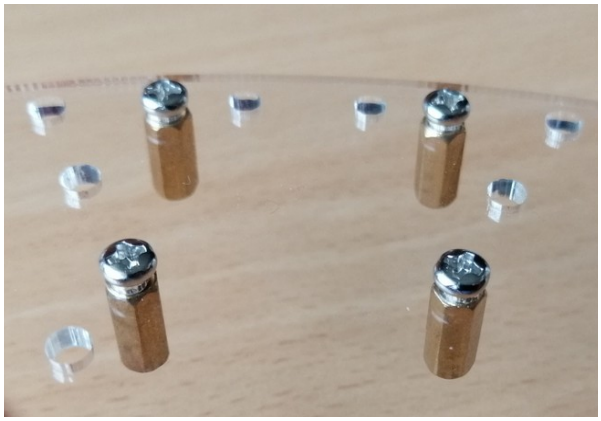
ARTIE: Artificial Intelligence in Education - challenges and opportunities of the new era:
development of a new curriculum, guide for educators and online course for students
Project co-funded by European Union under Erasmus+ Programme, 2020-1-HR01-KA201-077800

Step 5) Mount the motors using "T brackets"

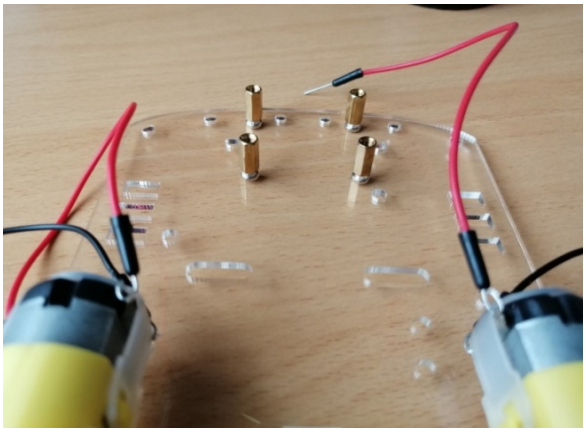





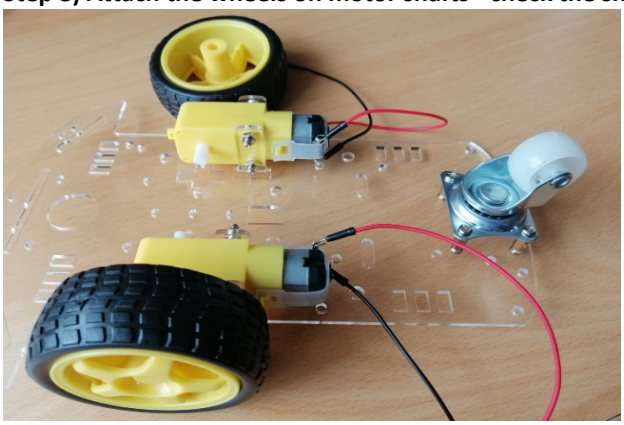
Step 7) Mount the small (rear) wheel using distance bolts

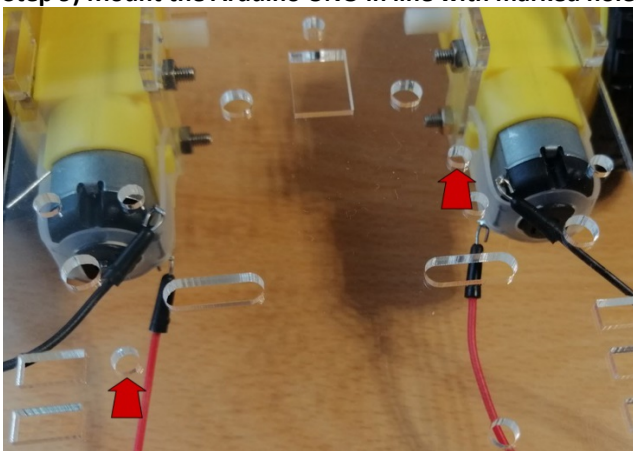
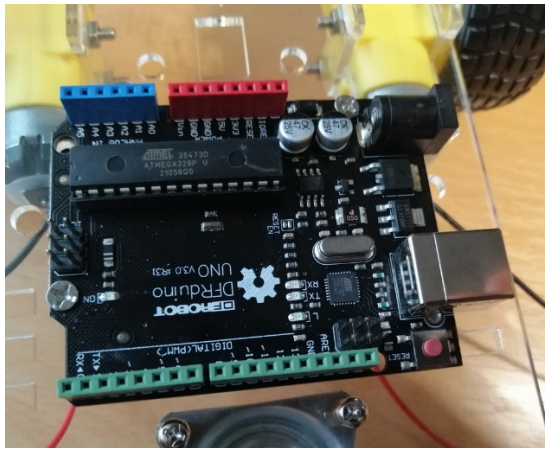
ARTIE: Artificial Intelligence in Education - challenges and opportunities of the new era:
development of a new curriculum, guide for educators and online course for students
Project co-funded by European Union under Erasmus+ Programme, 2020-1-HR01-KA201-077800



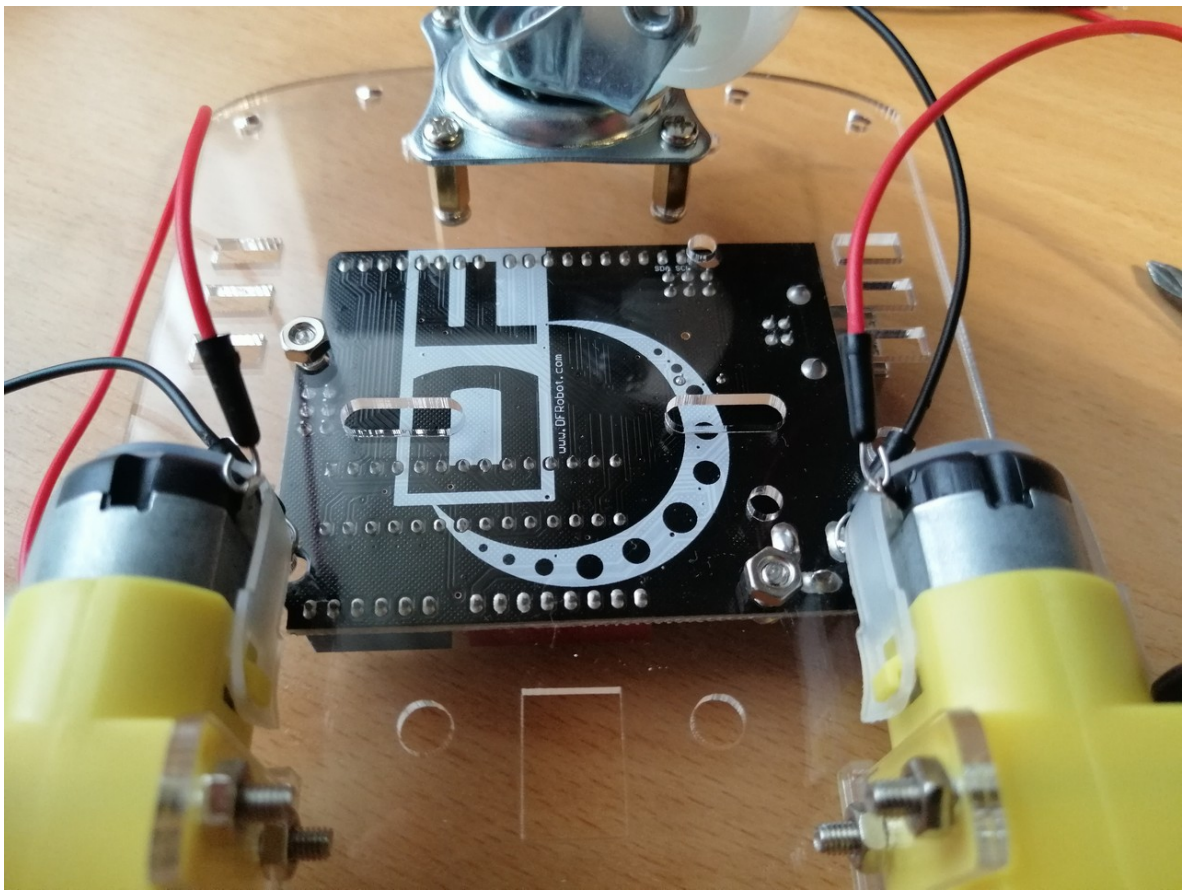

Step 8) Attach the wheels on motor shafts - check the shaft shape and wheel hole shape




Step 9) Mount the Arduino UNO in line with marked holes

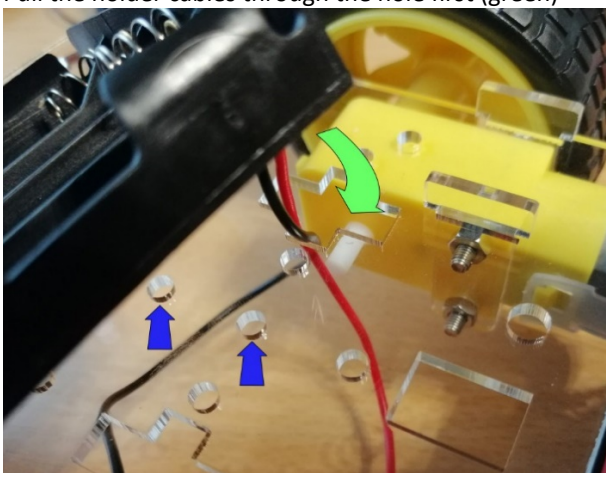



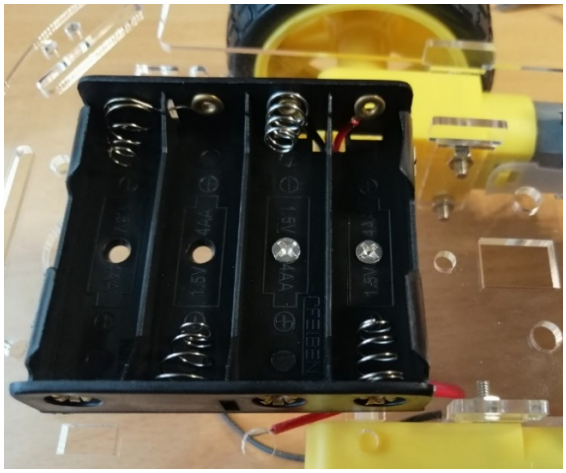
ARTIE: Artificial Intelligence in Education - challenges and opportunities of the new era:
development of a new curriculum, guide for educators and online course for students
Project co-funded by European Union under Erasmus+ Programme, 2020-1-HR01-KA201-077800



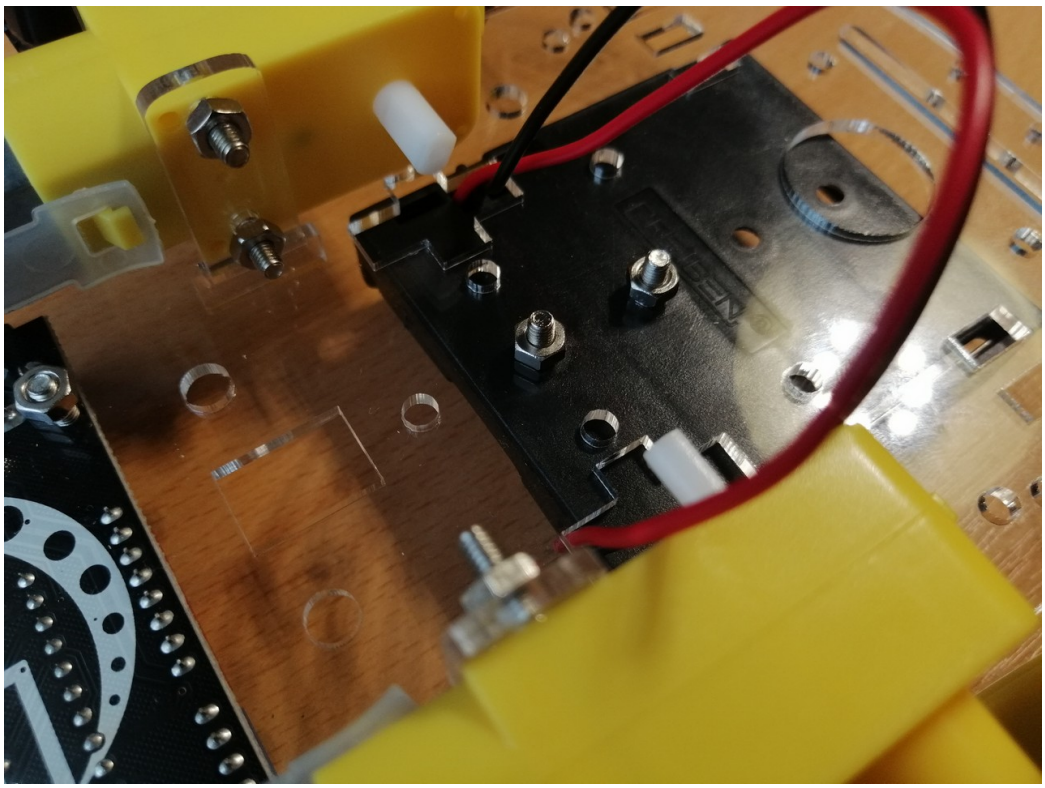
You can check this video for some details though we're using a slightly different approach:
https://www.youtube.com/watch?v=3a-bE1VlaU8

Step 10) Mount the first (bottom) battery holder using holes (blue)
Pull the holder cables through the hole first (green)

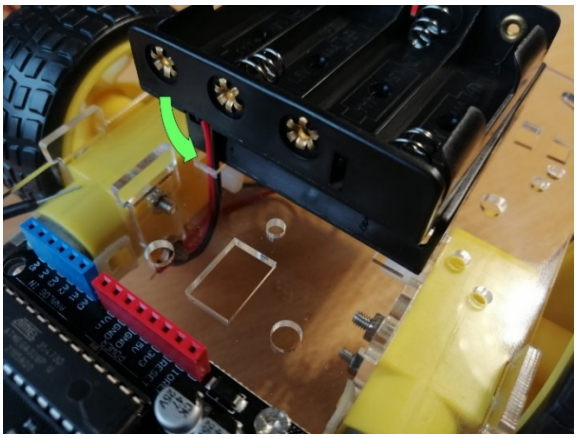


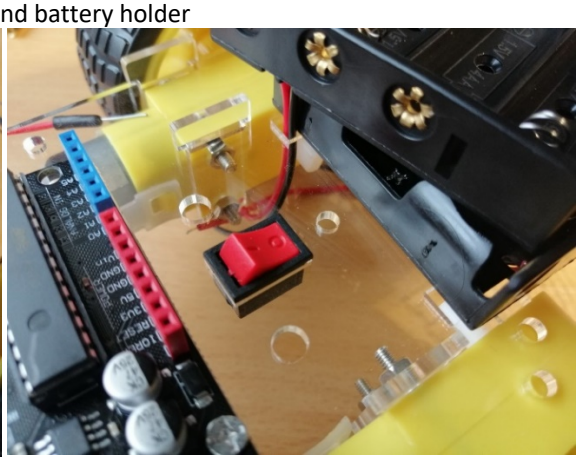


ARTIE: Artificial Intelligence in Education - challenges and opportunities of the new era:
development of a new curriculum, guide for educators and online course for students
Project co-funded by European Union under Erasmus+ Programme, 2020-1-HR01-KA201-077800

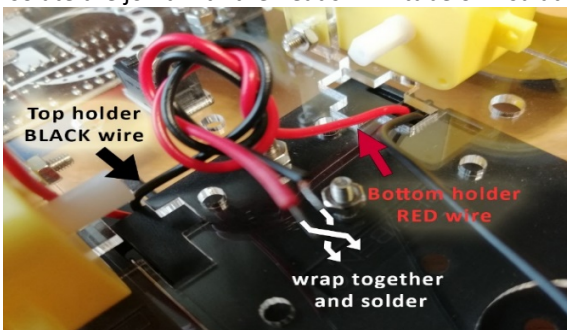


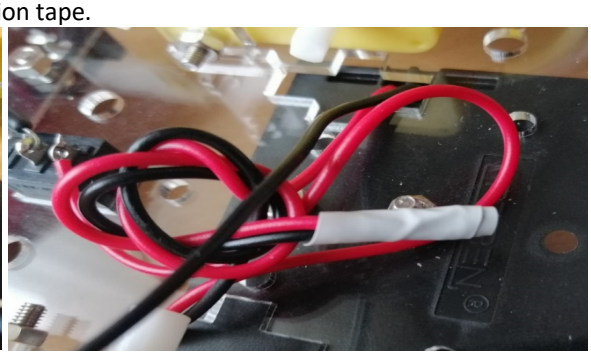
Step 11) Pull the second (top) battery holder cables through the marked hole (green)
Place the switch in the hole between Arduino UNO and battery holder





Step 12) Connect RED wire from bottom battery holder with BLACK wire from top battery holder
Isolate the joint with the heat shrink tube or insulation tape.

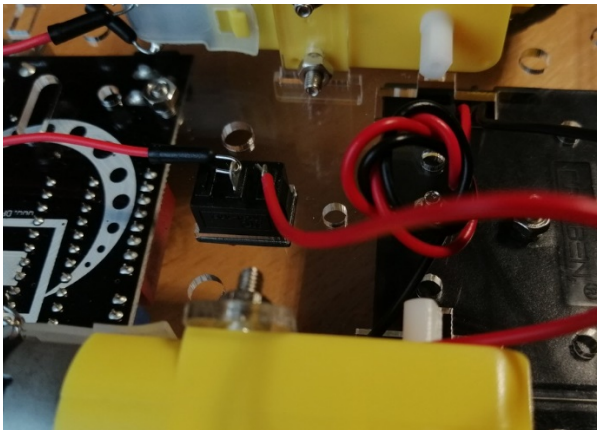
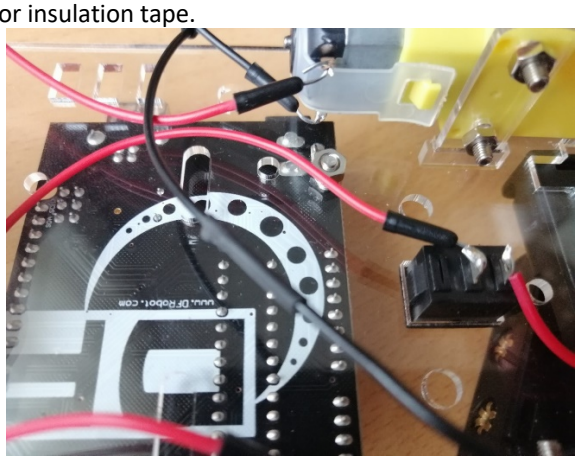




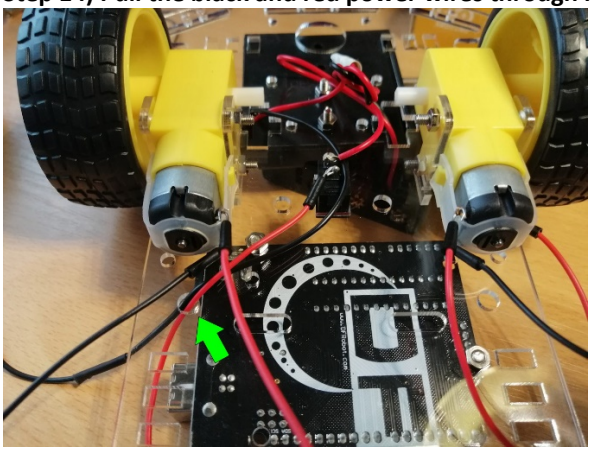
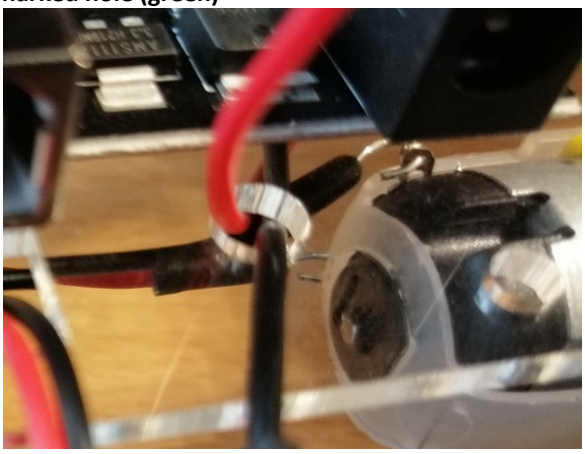
ARTIE: Artificial Intelligence in Education - challenges and opportunities of the new era: development of a new curriculum, guide for educators and online course for students
Project co-funded by European Union under Erasmus+ Programme, 2020-1-HR01-KA201-077800

Step 13) Solder the RED wire from bottom holder to switch

After that, solder the red jumper to the other switch contact. Solder the black jumper to the bottom holder BLACK wire. Isolate the joint with the heat shrink tube or insulation tape.

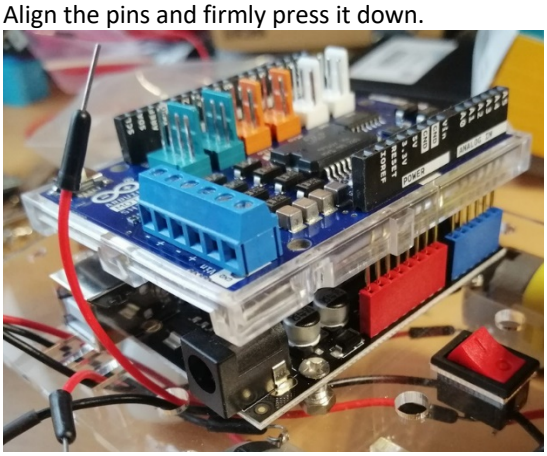
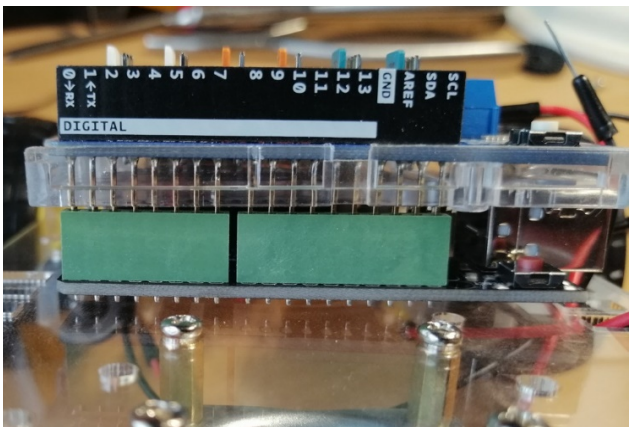



Step 14) Pull the black and red power wires through marked hole (green)

Step 15) Place the Arduino motor shield in Arduino UNO board

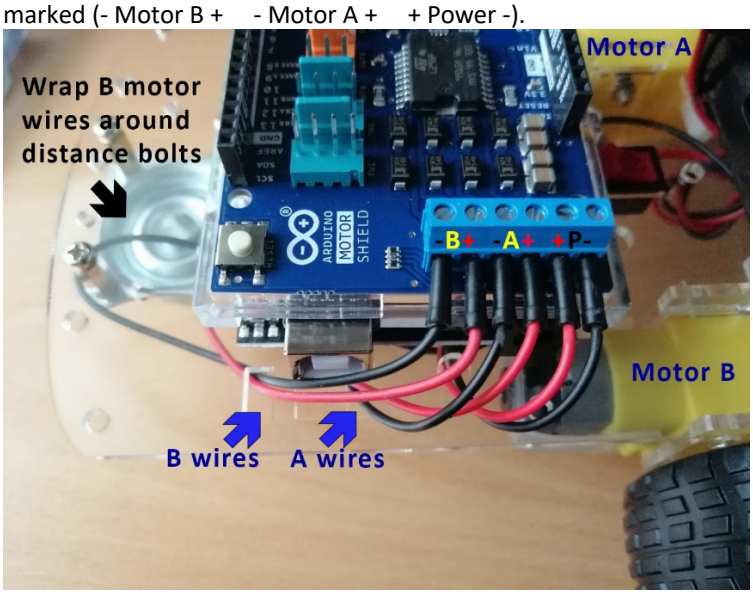
Align the pins and firmly press it down.

ARTIE: Artificial Intelligence in Education - challenges and opportunities of the new era:
development of a new curriculum, guide for educators and online course for students
Project co-funded by European Union under Erasmus+ Programme, 2020-1-HR01-KA201-077800

Step 16) Pull the motor wires through marked holes.

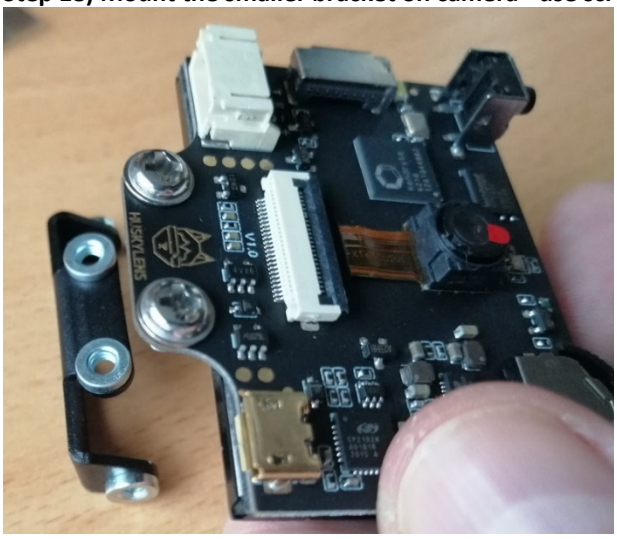
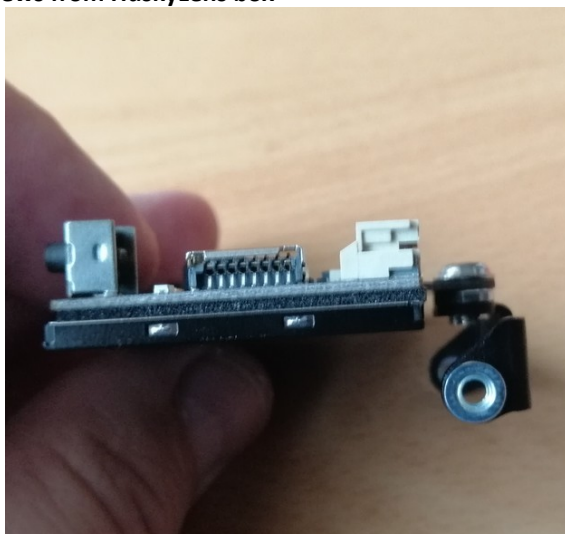
Shorten the jumper pins with cutting pliers and connect it to motor shield screw terminal connectors as marked (- Motor B + - Motor A + + Power -).



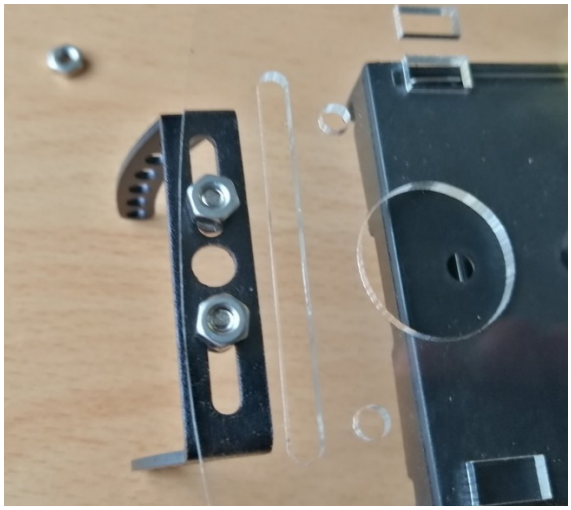
Step 17) Unbox the HuskyLens AI camera

ARTIE: Artificial Intelligence in Education - challenges and opportunities of the new era:
development of a new curriculum, guide for educators and online course for students
Project co-funded by European Union under Erasmus+ Programme, 2020-1-HR01-KA201-077800

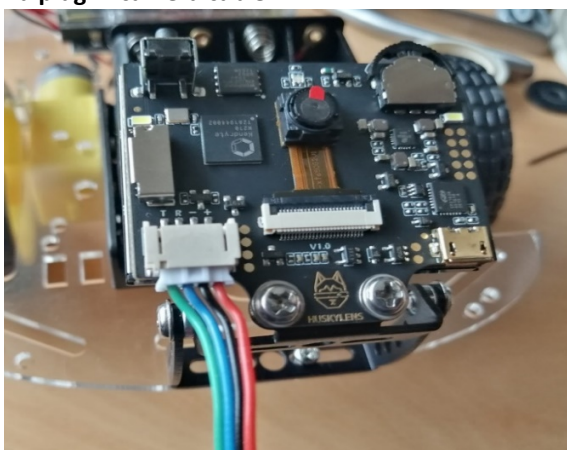
Step 18) Mount the smaller bracket on camera - use screws from HuskyLens box

Step 19) Mount the bigger camera bracket on robot chassis

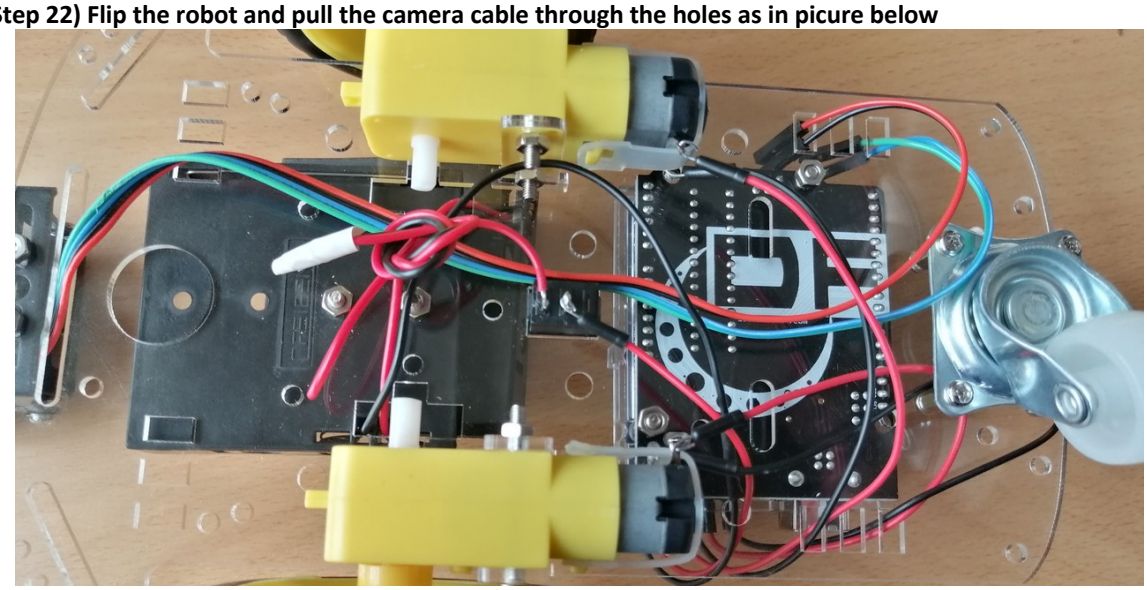
Step 20) Join two brackets with screws (not too tight) and plug in camera cable

ARTIE: Artificial Intelligence in Education - challenges and opportunities of the new era:
development of a new curriculum, guide for educators and online course for students
Project co-funded by European Union under Erasmus+ Programme, 2020-1-HR01-KA201-077800

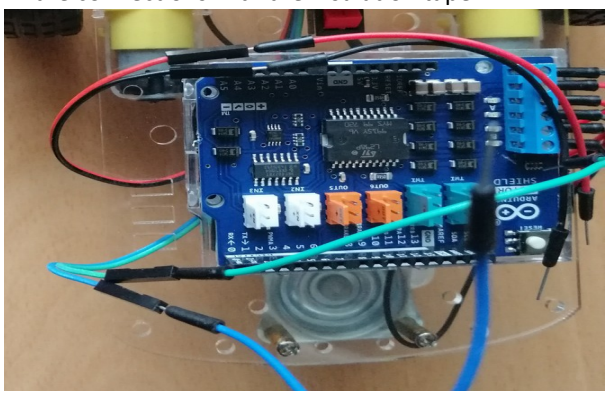
Step 21) Pull the camera cable through the hole

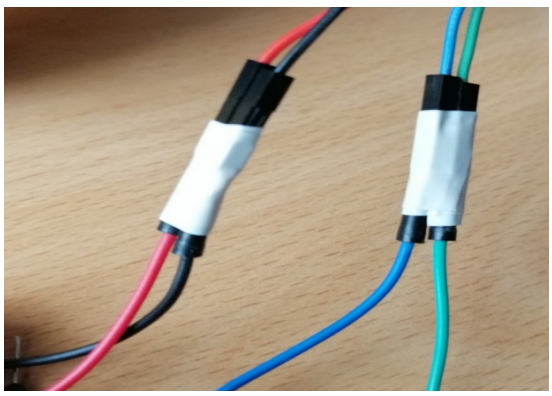
Step 22) Flip the robot and pull the camera cable through the holes as in picure below



Step 23) Connect the jumpers to the camera cable - match the jumper colour

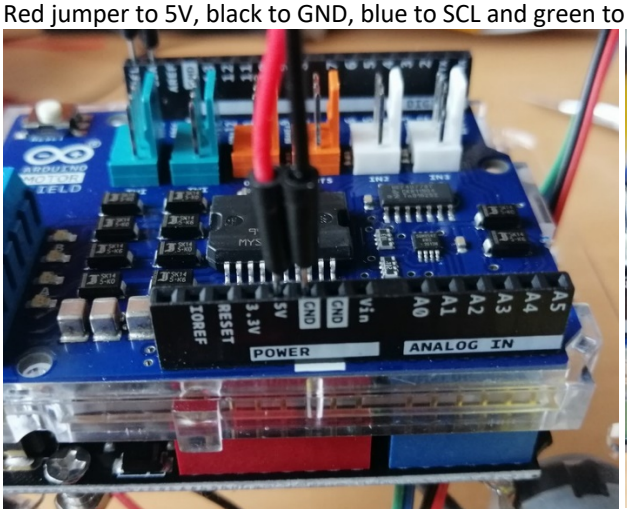
Fix the connections with the insulation tape.

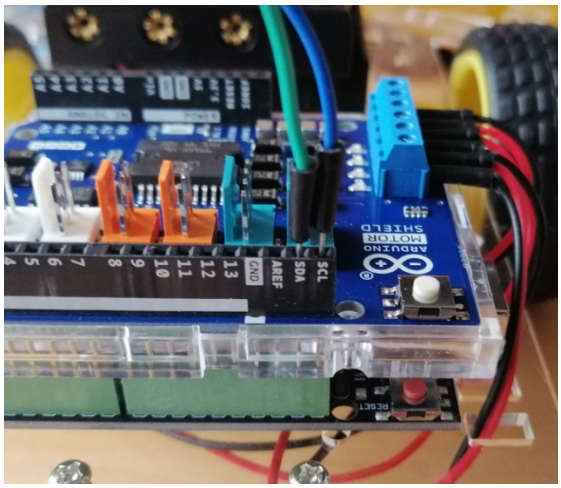




ARTIE: Artificial Intelligence in Education - challenges and opportunities of the new era: development of a new curriculum, guide for educators and online course for students
Project co-funded by European Union under Erasmus+ Programme, 2020-1-HR01-KA201-077800

Step 24) Plug in the power jumpers and I2C jumpers to the motor shield pins
Red jumper to 5V, black to GND, blue to SCL and green to SDA

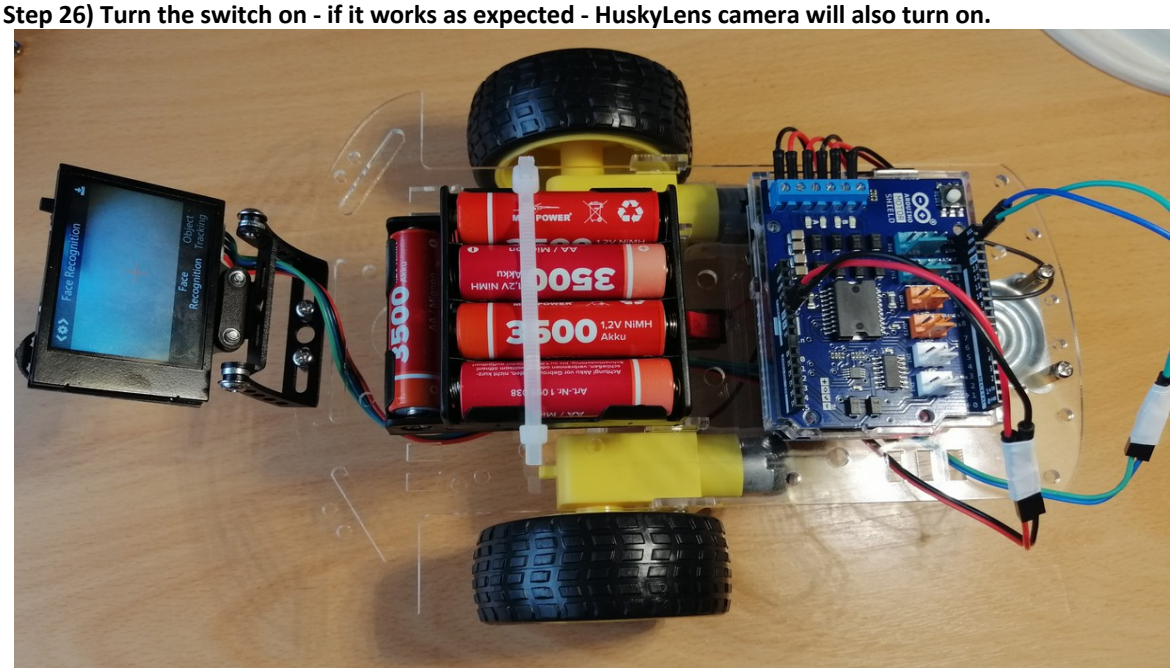




Step 25) Place the batteries in both holders
Use 2 cable tighteners to fix top and bottom battery holders (not too tight - you should be able to move the upper holder back and forth)

ARTIE: Artificial Intelligence in Education - challenges and opportunities of the new era:
development of a new curriculum, guide for educators and online course for students
Project co-funded by European Union under Erasmus+ Programme, 2020-1-HR01-KA201-077800

Step 26) Turn the switch on - if it works as expected - HuskyLens camera will also turn on.



Now we have assembled our ARTIEbot and we are ready to program our robot to see it in action.

CONCLUSION

Discuss with your students the differences and similarities between ARTIEbot and Maqueen Plus.
Do the K.W.L. (**K**now, **W**ant, **L**earned) chart with your students.

What I **K**now	What I **W**ant to Know	What I **L**earned

Methods	***Work forms***
presentation *interactive exercise / simulation on the computer*	*work in pairs* *group work*

ARTIE: Artificial Intelligence in Education - challenges and opportunities of the new era:
development of a new curriculum, guide for educators and online course for students
Project co-funded by European Union under Erasmus+ Programme, 2020-1-HR01-KA201-077800

Material:

- https://botland.store/chassis-for-robots/7283-chassis-rectangle-2wd-2-wheel-robot-chassis-with-dc-motor-drive-5904422335649.html
- https://botland.store/various-wires/1022-connecting-cables-male-male-65pcs.html
- https://botland.store/battery-holders/173-battery-holder-4-x-aa-r6-5904422329389.html
- https://botland.store/screws-and-nuts/637-screws-nuts-and-washers-set-330pcs-5410329304478.html
- https://store.arduino.cc/collections/boards/products/arduino-uno-rev3
  https://botland.store/arduino-compatible-boards-dfrobot/2683-dfrduino-uno-v3-compatible-with-arduino.html
- https://store.arduino.cc/collections/shields/products/arduino-motor-shield-rev3
- https://store.arduino.cc/collections/dfrobot/products/gravity-huskylens-ai-machine-vision-sensor
- https://www.youtube.com/watch?v=xSWKnnvGWBs

Literature

-

PERSONAL OBSERVATIONS, COMMENTS AND NOTES