



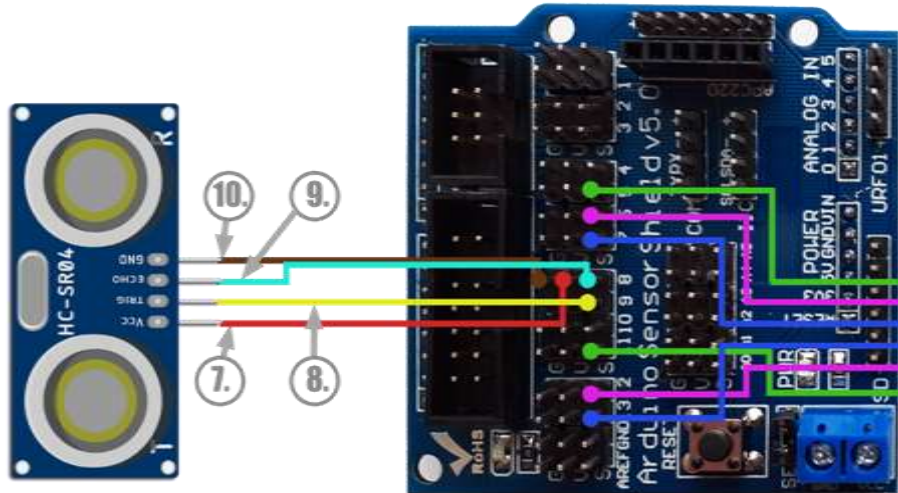
The DIY automobile project (Level 2)

Worksheet for students

Team:.....

Time for circuit making!

The image below illustrates the way that the Ultrasound sensor is connected to the Shield.



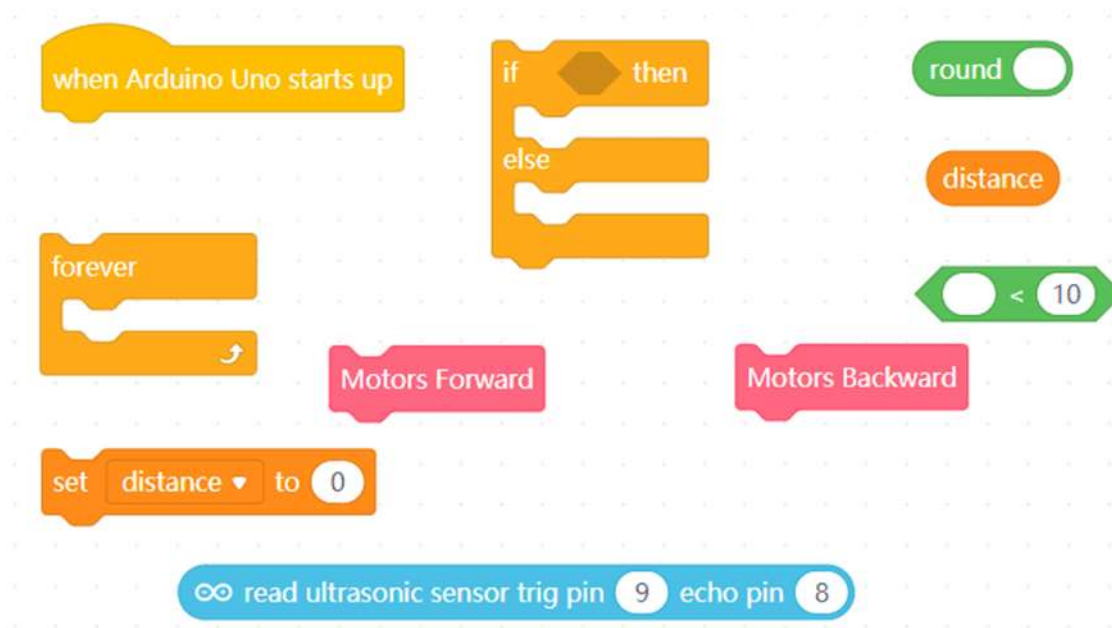
In particular, the Vcc (7.) and Ground (10.) pins are respectively connected to a 5V and a Ground pin of the shield (pin 8 in the example). The Trigger pin (8.) is connected to a PWM pin (pin 9 in the example) and the Echo (9.) to one of digital pins (pin 8 in the example)

Can you describe how the Ultrasound sensor operates? *Please write your thoughts below:*

Time for programming!

Open mBlock and connect your Arduino.

The following script (see below) is semi-structured. Find the blocks and place them in the correct order into the scripting area, in order to create a script that allows the DIY automobile to detect and avoid obstacles.



Notes:

- You can create a new procedure through **my block** palette, by clicking on “Make a Block” tab.
- You can read the ‘distance’ of an obstacle through the ‘**read ultrasonic sensor**’ block.
- You can create a new variable ‘distance’ through the **Variables** palette. Set the variable ‘distance’ to read the value of the ultrasonic sensor.
- When Arduino starts up, the value of the distance (which is assigned to the values received by the Ultrasound sensor) is repeatedly compared to a user defined value (i.e. 10). Therefore, if the value of the distance is smaller than 10 then, the DIY automobile is moving backwards. Otherwise, the automobile is moving forwards.

What will happen if you change the value of the distance (i.e. from 10 to 20)? *Please write your answer below:*

Try the script below.

```
when Arduino Uno starts up
forever
  set distance to read ultrasonic sensor trig pin 9 echo pin 8
  if round distance < 10 then
    turn right
    wait 0.5 seconds
    Motors Backward
  else
    Motors Forward
```

What will happen if you change the duration ('wait' block) between "turn right" and "Motors Backward" blocks?

Tips zone

Programming blocks

A yellow hat-shaped block with the text "when Arduino Uno starts up".

when Arduino Uno starts up

This is an Arduino extension Event block that executes the subsequent script when Arduino board starts up.

A blue block with a hat-shaped top, containing the text "set PWM" followed by a circular input field with the number "5", and "output as" followed by a circular input field with the number "0".

set PWM 5 output as 0

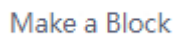
This block sets the output of the selected PWM pin to the specified value.

PWM signals can be used to control the speed of DC motors. Pins 3, 5, 6, 9, 10, and 11 of Arduino Uno can be used as PWM output. The range of values varies from 0 to 255, where 0 indicates the duty cycle of 0%, and 255 the duty cycle of 100%

A blue block with a hat-shaped top, containing the text "set digital pin" followed by a circular input field with the number "9", and "output as" followed by a dropdown menu showing "high".

set digital pin 9 output as high

Sets the output of the selected digital pin to low (false) or high (true) level.

A white rectangular button with a thin border and the text "Make a Block".

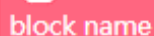
Make a Block

Click on **Make a Block** command to create a procedure that contains a number of consecutive commands (i.e. Move Forward).

A red block with a hat-shaped top, containing the text "define" followed by a smaller red block with the text "block name".

define block name

Drag the needed function blocks and assemble them under the hat block "**define()**" to set a new procedure (i.e. all the needed functions to make your Automobile move forward).

A red block with a hat-shaped top, containing the text "block name".

block name

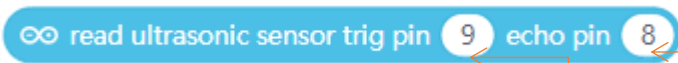
Use the created procedure (i.e Move Forward) into the main code, under the Event hat block. When the procedure runs, mBlock will run the blocks below the corresponding Define block.

Make a Variable

Click on **Make a Variable** command to create a variable that contains the ultrasound sensor's distance value.



This block comes from the Variables palette and sets the variable '*distance*' to a specific value. This value can be inserted manually or can be linked to the values received from specific sensors (i.e. an ultrasound sensor).



This block comes from the Sensor palette and defines where the **trigger** and **echo** pins of Ultrasound sensor are connected. The return value of the block is the '*distance*' of the obstacle in cm.



This block comes from the Operators palette and executes the subsequent script if the value of the specified parameter (i.e distance) is smaller than the manually specified value (distance of 10cm in the example).







This block comes from the Operators palette and rounds the number to the nearest integer.



Through this block, a number of consecutive commands are assigned to the "turn left" procedure, instructing the DIY automobile to turn left (pivot).

Electrical components

The following table is an index containing the main electrical components that need to be implemented for accomplishing the present activity.

	<p>DC Motor</p>
	<p>L298n driver</p>
	<p>Arduino Sensor Shield</p>
	<p>Ultrasonic Sensor</p>

ROBOSCIENTISTS PROJECT

Motivating secondary school students towards STEM careers through robotic artefact making

Erasmus+ KA2 2018-1PL01-KA201-051129

Creators

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Declaration

This report has been prepared in the context of the ROBOSCIENTISTS project. Where other published and unpublished source materials have been used, these have been acknowledged.

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