

### SCENARIO

<b>Title</b>	BIKE ENCOUNTERED	
<b>Summary</b>	This exercise consists of the typical mathematical problem in which two individuals meet at a certain point taking into account the speed of movement. The Arduino shield will perform the verification of the entered results.	
<b>Author/s</b>	AIJU	

### DIDACTIC OBJECTIVES

- Teach math in a different and attractive way.
- Teach how to calculate times based on speed and distance.

Physics       Mathematics **X**      Information Technology       Robotics       Programming

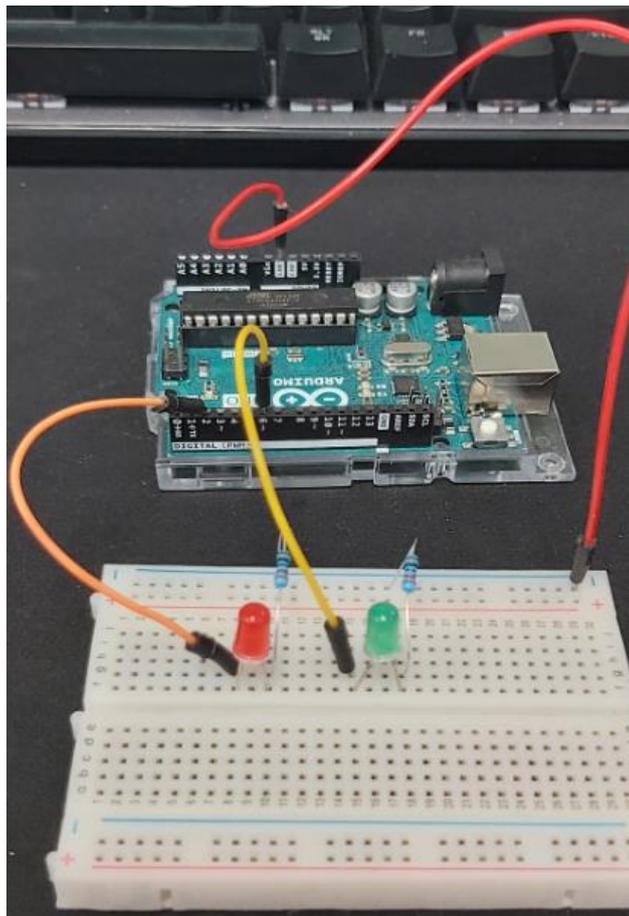
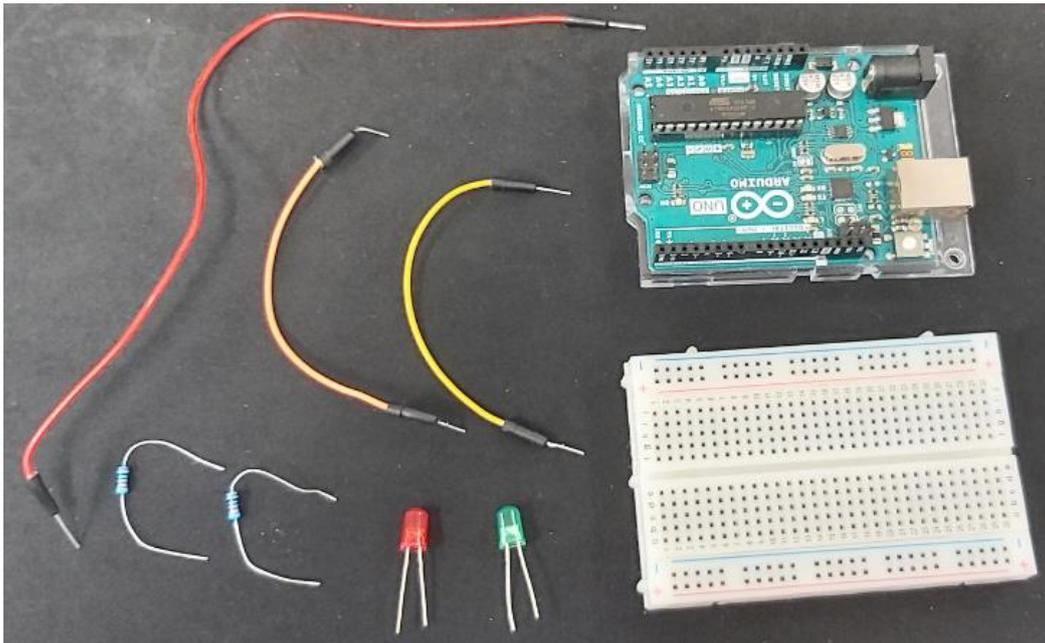
Education Level:              10-12 years **X**              12-14 years

### PROBLEM STATEMENT

Some students have problems understanding the concept of what the mathematical problem asks, so through a visual example it is intended to facilitate learning and understanding.

### BOM (Bill Of Materials needed)

- Arduino Device
- Board
- (x2) Leds (Red and Green)
- (x3) Cables
- (x2) Resistors



„InnoExperiment – Innovative Approach to Teaching through Experiment”

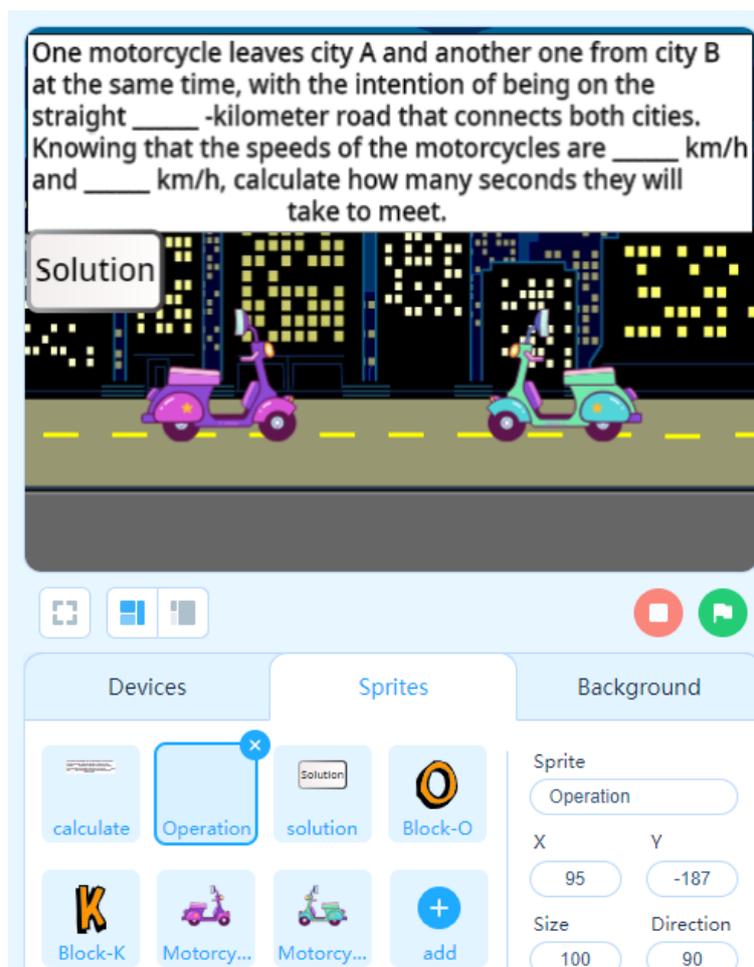
Project Leader: Zespół Szkolno – Przedszkolny w Goniądzu (ZSP)



## ACTIVITY DESCRIPTION

For the development of the activity, we will use software that allows us to unify the game developed in Scratch with the use of the Arduino board. In this case, we have used the mBlock software: (<https://mblock.makeblock.com/en-us/>)

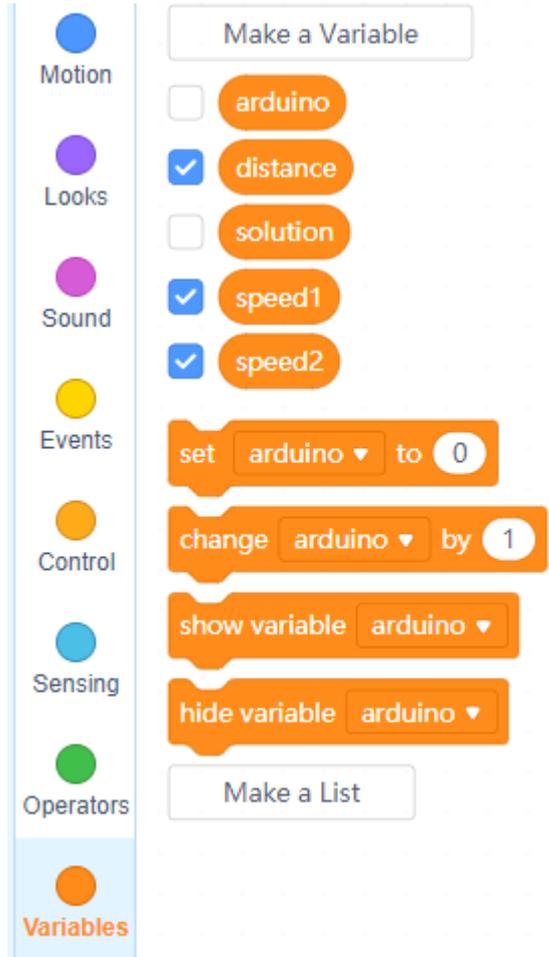
First of all, we will make the graphic composition of the activity:



We add the “Distance”, and Speed, “Speed1” and “Speed2”, variables for the problem statement:

One motorcycle leaves city A and another one from city B at the same time, with the intention of being on the straight **48**-kilometer road that connects both cities. Knowing that the speeds of the motorcycles are **97** km/h and **56** km/h, calculate how many seconds they will take to meet.

Solution

Motion

Looks

Sound

Events

Control

Sensing

Operators

Variables

Make a Variable

arduino

distance

solution

speed1

speed2

set arduino to 0

change arduino by 1

show variable arduino

hide variable arduino

Make a List

In addition, we will create the "Solution" variable, which will be the one that calculates the solution to the problem, and the "Arduino" variable, which will be in charge of sending to the Arduino board when and that the corresponding LED lights up.

Once we have the graphic composition and the variables created, we will start with the programming:

1. We will start by setting the visual background that we want to appear while the mathematical problem is being posed and we will set the "Arduino" variable to 0, so that the LEDs are off. In addition, for the "Distance", "Speed1" and "Speed2" variables, random values will be created, so that whenever the Activity starts, different values come out:

```

when clicked
  switch backdrop to Night City With Street
  set arduino to 0
  forever
    hide variable solution
    set distance to pick random 10 to 100
    show variable distance
    set speed1 to pick random 20 to 120
    show variable speed1
    set speed2 to pick random 20 to 120
    show variable speed2
  
```

2. Then, we apply the formula that will calculate the problem:

```

set solution to distance / speed1 + speed2 * 60
  
```

3. Next, the system wait for the user to write the result:

```

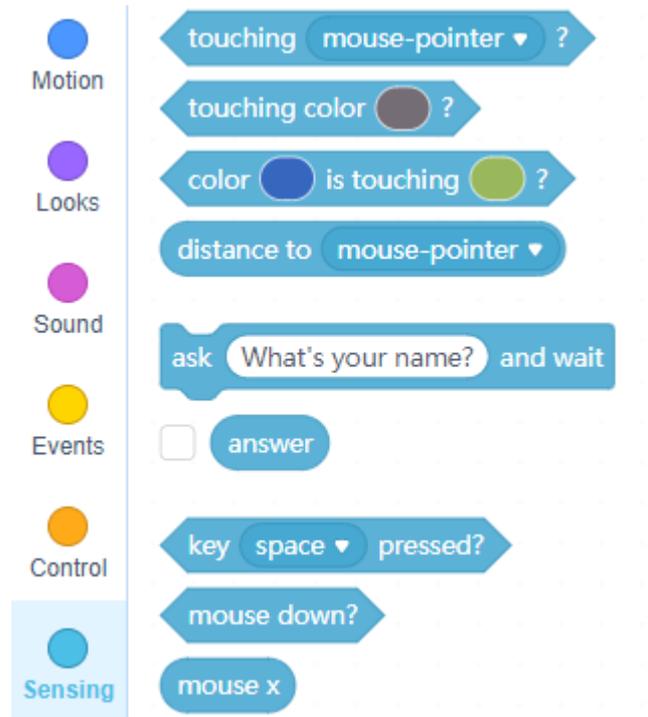
ask answer and wait
  
```

One motorcycle leaves city A and another one from city B at the same time, with the intention of being on the straight 83 -kilometer road that connects both cities. Knowing that the speeds of the motorcycles are 48 km/h and 76 km/h, calculate how many seconds they will take to meet.

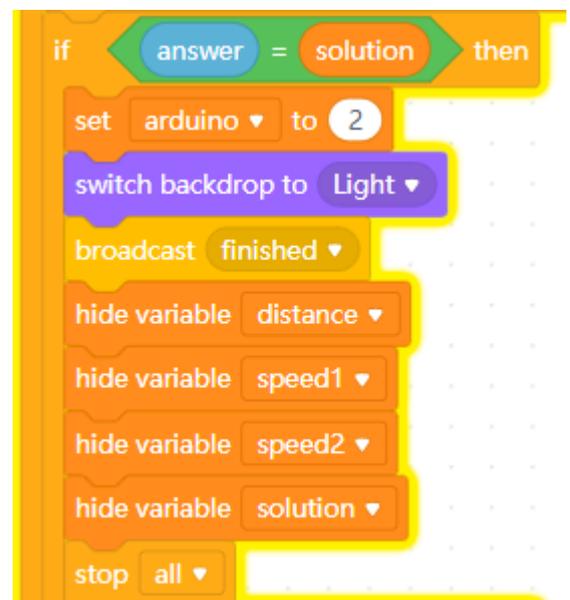
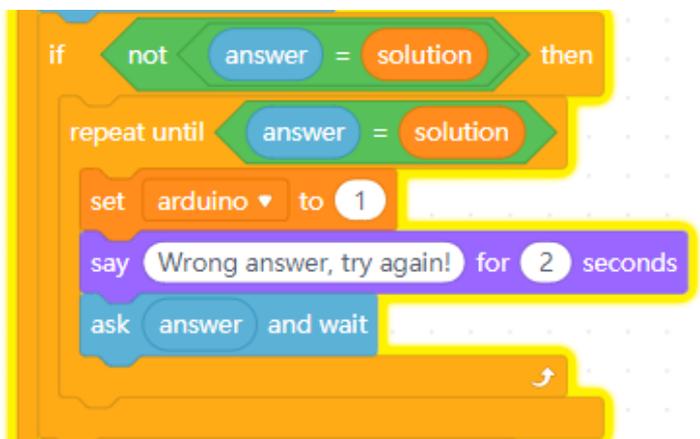
Solution



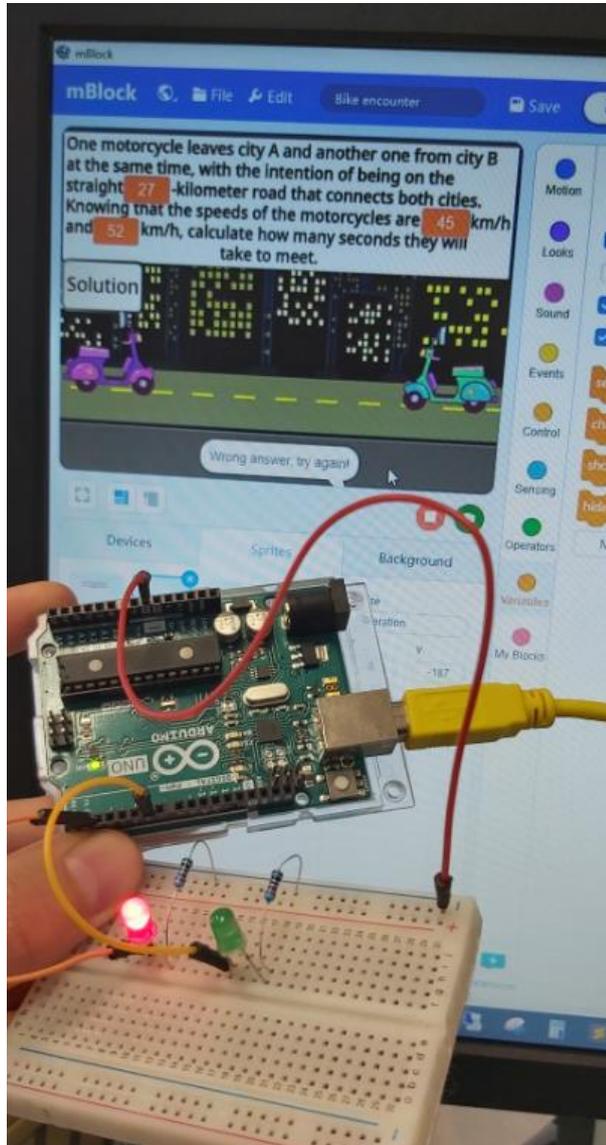
4. The result indicated by the user will be saved in a variable called “answer”, which will be created in the “Sensing” section:



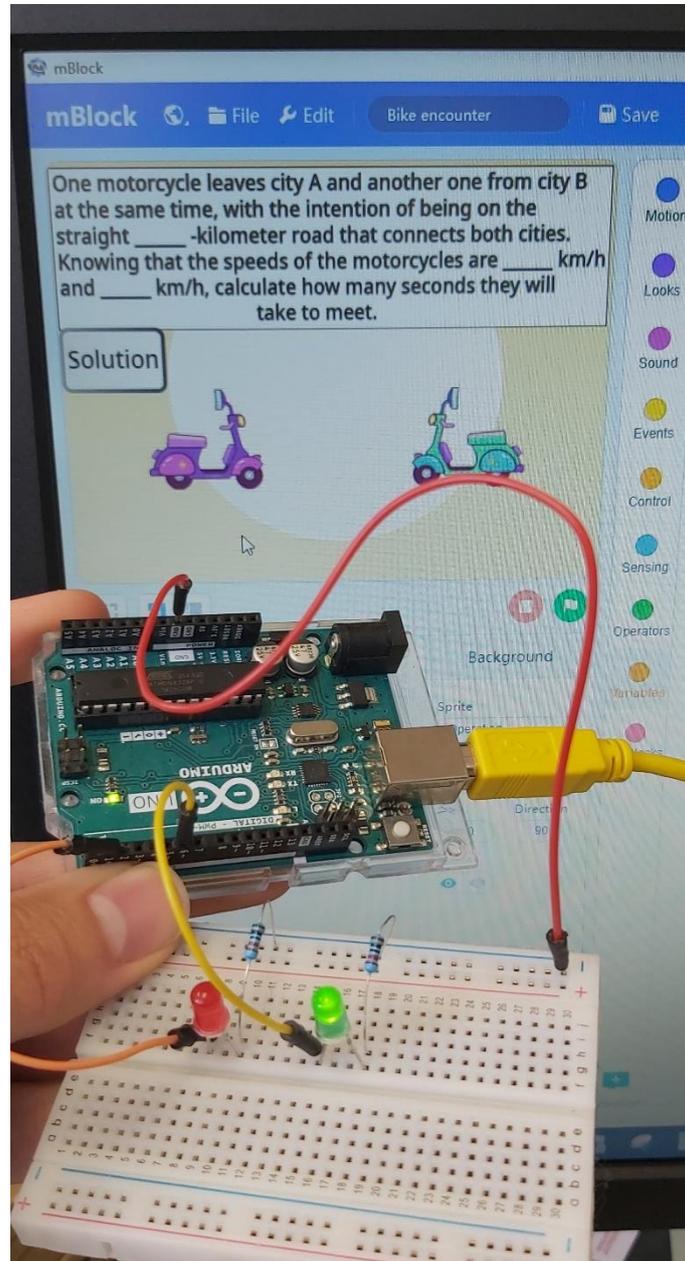
5. Once the answer has been inserted, the programming will check to verify the result:



6. If the entered result is wrong, the game will display "Wrong answer, try again!" and will prompt the user to retype the answer. In this block the Red LED of the Arduino will light:



7. If, on the contrary, the user types the correct answer, the Green LED will light up and the variables will be hidden and the background will change:



8. The main Code would be as follows:

One motorcycle leaves city A and another one from city B at the same time, with the intention of being on the straight \_\_\_\_-kilometer road that connects both cities. Knowing that the speeds of the motorcycles are \_\_\_\_ km/h and \_\_\_\_ km/h, calculate how many seconds they will take to meet.

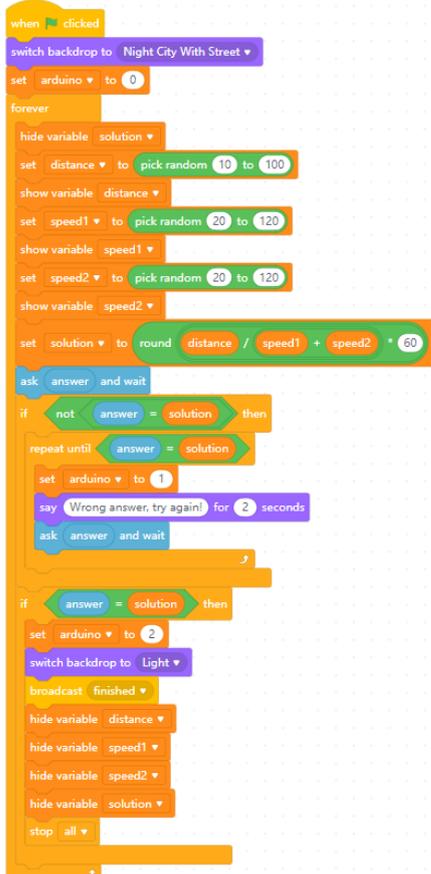
**Solution**



**Make a Variable**

- arduino
- distance
- solution
- speed1
- speed2

**Make a List**



**Devices**

calculate Operation solution Block-O

Block-K Motorcy... Motorcy... add

**Sprites**

Sprite Operation

X: 95 Y: -187

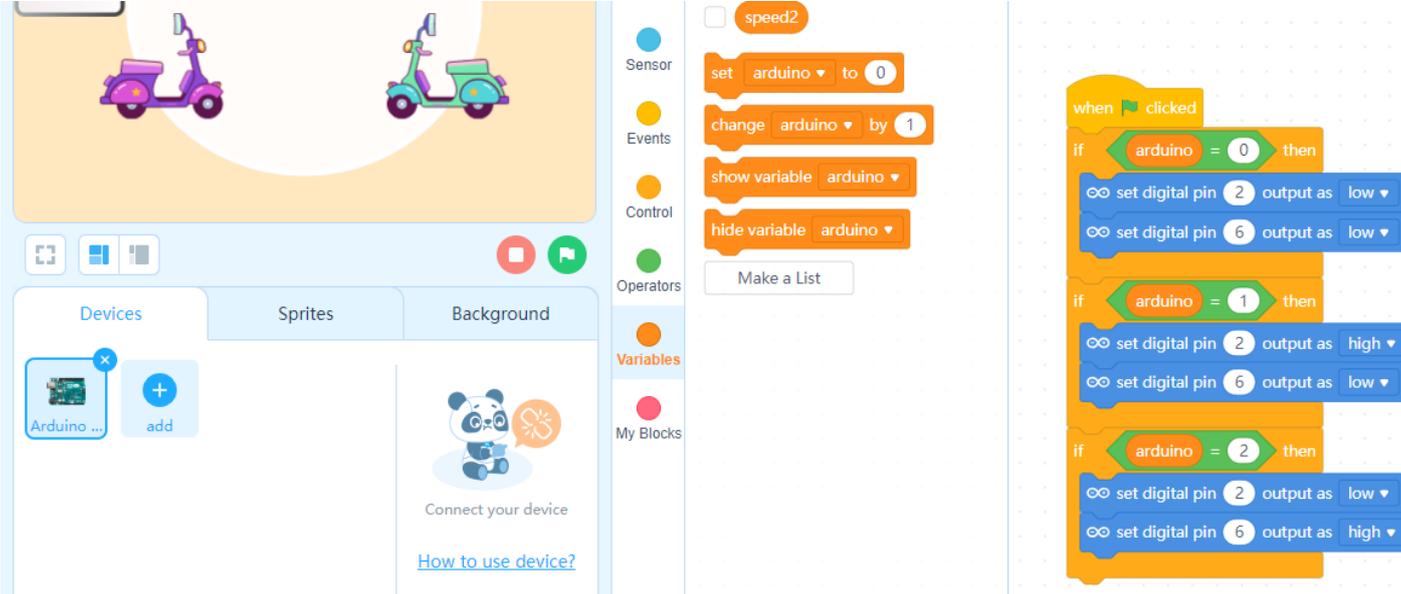
Size: 100 Direction: 90

Show:

Costumes

**Background**

9. The code that would be in charge of lighting the LEDs on the Arduino board would be as follows:



The screenshot shows the Scratch code editor interface. On the left, there are two scooter sprites. The 'Variables' panel shows a variable named 'speed2' with a 'set speed2 to 0' block. The 'Code' area contains the following script:

```

when clicked
  if (arduino = 0) then
    set digital pin 2 output as low
    set digital pin 6 output as low
  if (arduino = 1) then
    set digital pin 2 output as high
    set digital pin 6 output as low
  if (arduino = 2) then
    set digital pin 2 output as low
    set digital pin 6 output as high
  
```

### STUDENTS' EVALUATION

The way to evaluate the students would be for them to demonstrate on paper how they have developed the exercise and to use the program / game to check the solutions.

### SCALABILITY

Regarding the concept of scalability, the complexity could be increased by adding problems that need more parameters, such as a third component in which they have to be found, or determining the speed of an element so that they meet in a certain second.