

DON'T APPROACH!



STEMJAM Teaching Guide

Developing make spaces to promote creativity
around STEM in schools

Acronym: STEMJAM

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www.stemjam.eu



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DON'T APPROACH!

ABSTRACT

We know that looking closely at the television and computer screen hurts our eyes. However, adults and children look at the screen and damage their eyes. We did this project for it. The ultrasonic sensor, which detects an object as close as 30 cm to the screen, notifies the relay that the electricity is cut off. When the object goes 30 cm away, it gives the screen the electricity by the same method. Due to 220 v of electricity is used in this study, students should definitely work on parent / teacher control.

You can use the mBot original kit, instead of using Arduino components.

DIDACTIC OBJECTIVES

- ❖ Introduction to computational thinking.
- ❖ Assimilation, creation and programming of algorithms.
- ❖ The student knows what the arduino card is and what it is used for.
- ❖ Students have knowledge about alternating current.
- ❖ Students know concepts such as setting up an electrical circuit, isolation, etc.
- ❖ Learning how to use the ultrasonic sensor.
- ❖ Learning about healthy habits when using electronic devices.
- ❖ Learning about eye damaging produced by short distances to the screen.

STEM Subject: Science Technology Engineering Mathematics

Education Level: 12-14 years 14-16 years

PROBLEM STATEMENT

The ultrasonic sensor will detect and compare the distances between a person and the screen. The objective is to check if this person is too close to the screen, and if he/she is so, to give a warning and stop the game.

BOM (Bill of Materials Needed)

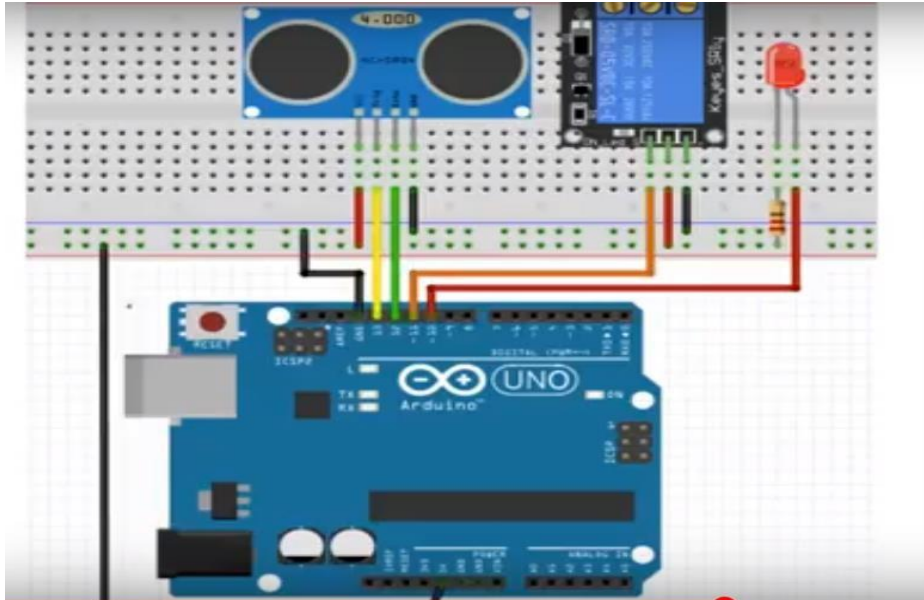
- ❖ Arduino Uno.
- ❖ Jumper cables.
- ❖ Hc-Sr04 Ultrasonic Sensor.
- ❖ Relay.
- ❖ Screen.
- ❖ mBlock or Arduino IDE.
- ❖ Usb cables, 220 v electric cables, globe, etc.



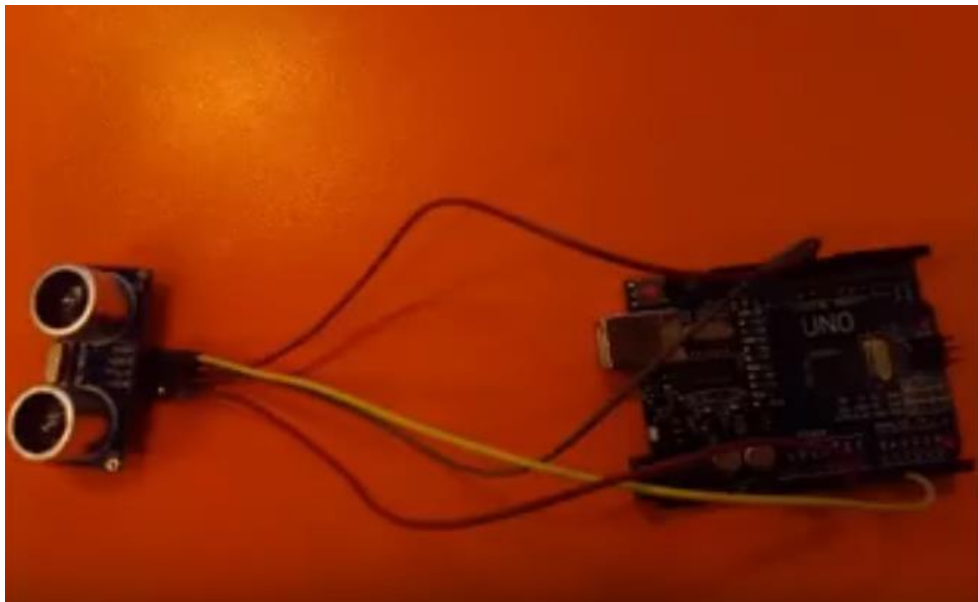
ACTIVITY DESCRIPTION

First version

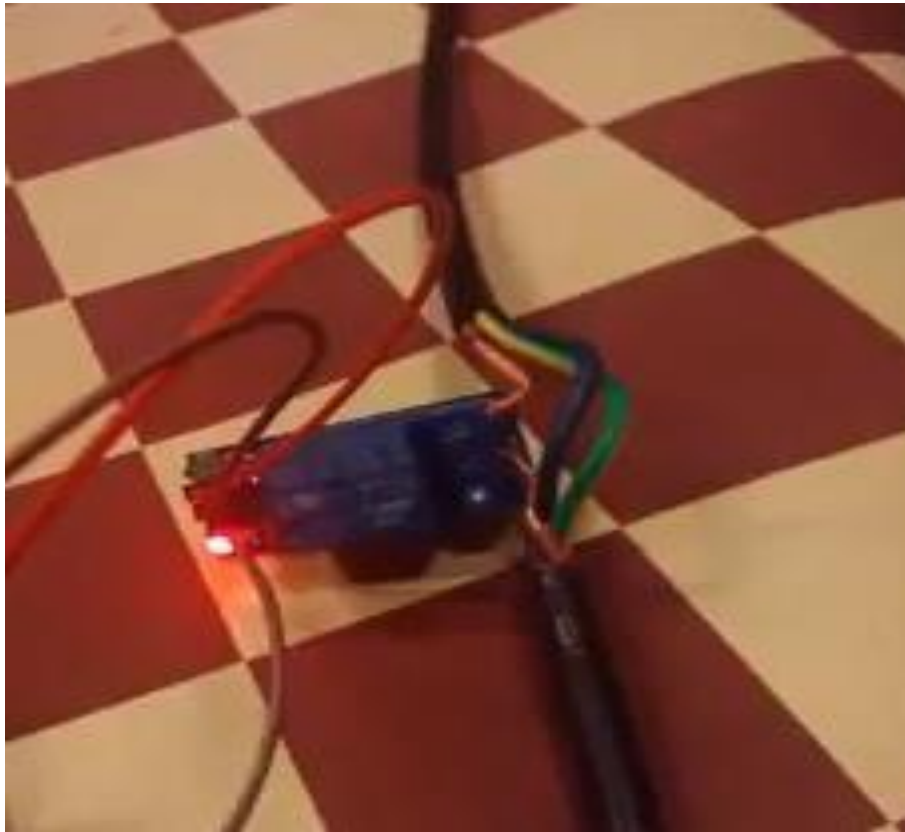
Step 1: Before connecting circuits, we organize circuit elements in a program. We preferred the fritzing program.



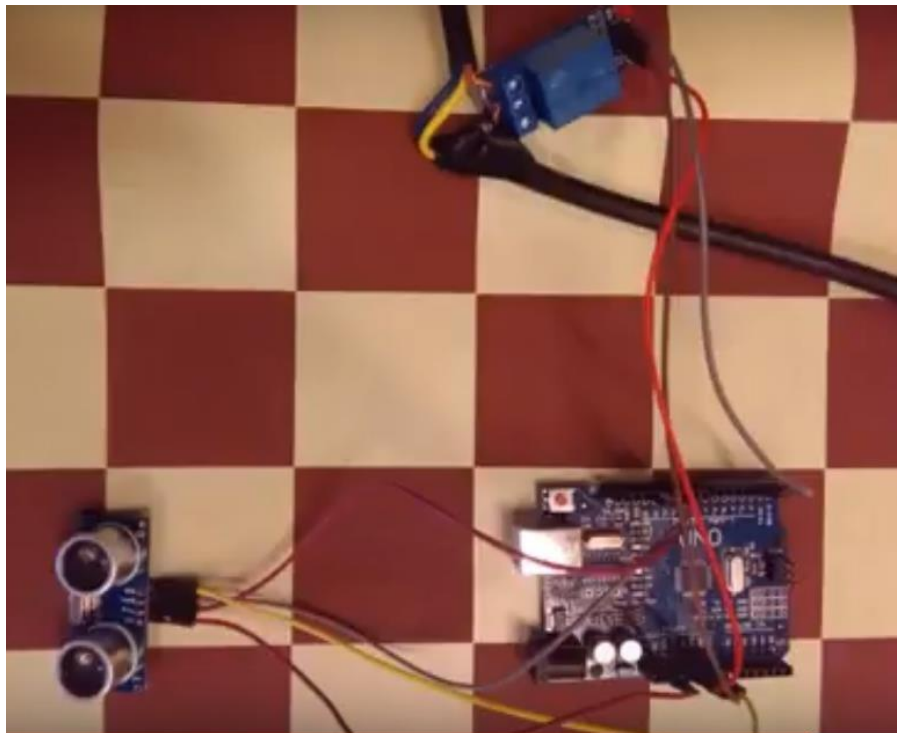
Step 2: Hc-Sr04 and our arduino uno card connections using by jumper cables.



Step 3: Cut the electric cable with the help of a knife from a suitable place, and connect it to any cable except the twin color cable.



Step 4: Let's connect the relay to the arduino card and Lets make a circuit like that.



Note: Sections like that 5v and gnd on Arduino, not changed,we can change the digital batteries. We must use codes too.

Step 5: mBlock codes



```
Arduino Program
forever
  set uzaklık to read ultrasonic sensor trig pin 13 echo pin 12
  serial write text uzaklık
  if uzaklık > 0 and uzaklık < 30 then
    set digital pin 3 output as HIGH*
    wait 1 secs
  if 40 < uzaklık then
    set digital pin 3 output as LOW*
    wait 1 secs
  wait 1 secs
```

Step 6: Let's connect the circuit to your display. But direct contact with the screen can create a short circuit, let's be careful about insulation.



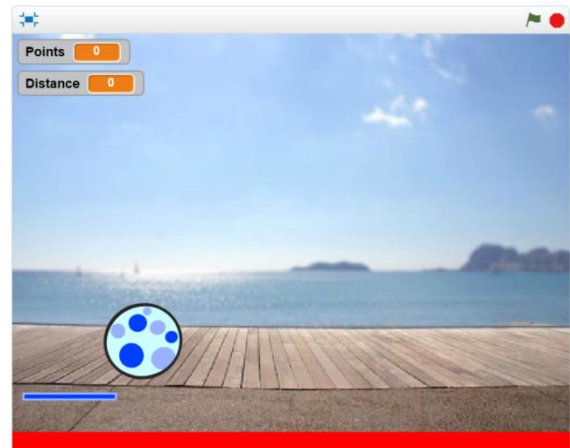
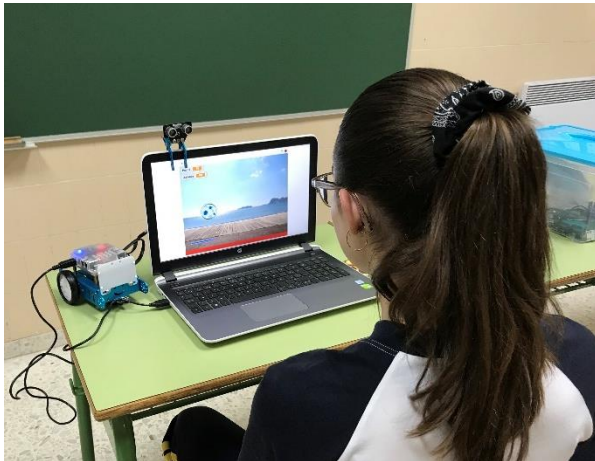
Second version

The aim of the activity is to detect and compare the distance between a person and a screen by programming the ultrasonic sensor. There will occur two different responses to a short approach: themBot will perform light and sound effects while the screen will show a message and end the running game.

1. ACTIVITY SEQUENCE:

The activity will be developed as follows:

Step 1: a student has created a videogame using scratch and now is playing with it.



Step 2: little by little, this student approaches to the screen. If he/she arrives to a distance between 40 and 25 cm to the screen, the mBot will warn about this short distance by performing “First Warning” routine.

This *First Warning* will contain:

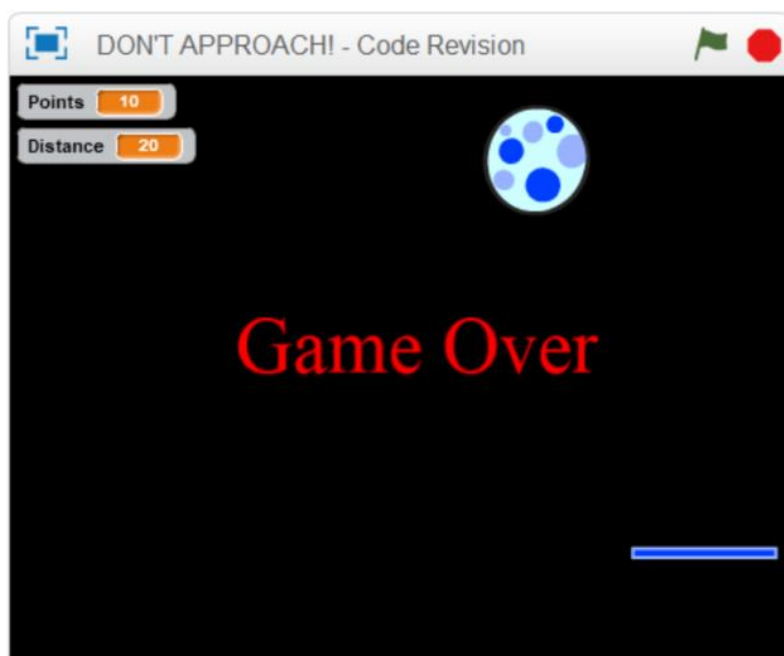
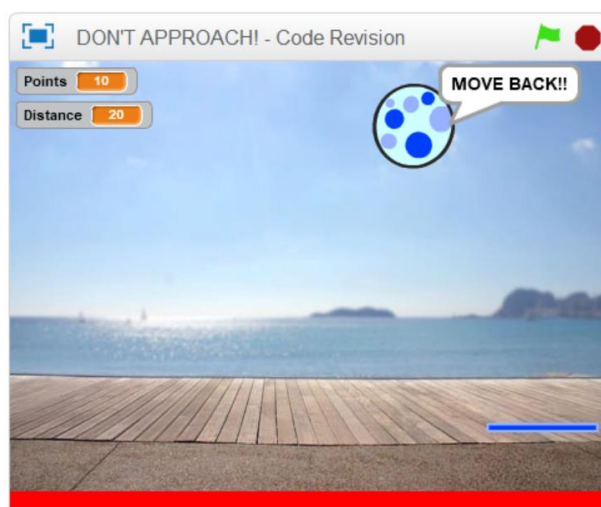
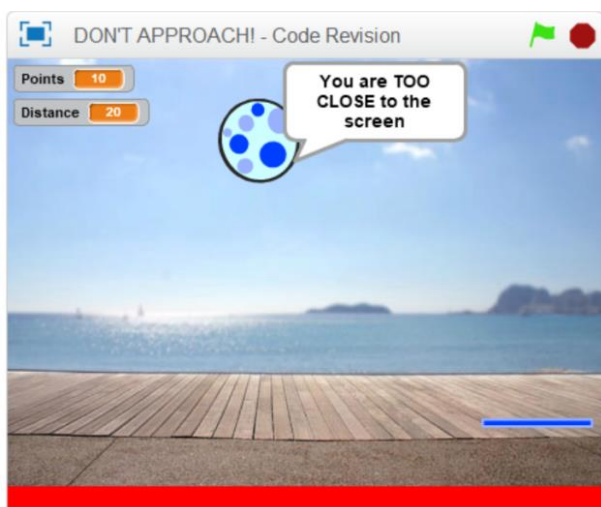
- ❖ Sound effects.
- ❖ Light effects.
- ❖ A warning face showed in the LED matrix.
- ❖ The following warning message appearing on the laptop screen: “You are getting closer to the screen...move back!”



Step 3: If the student ignores the first warning and approaching to the screen (to a distance smaller than 25 cm), the mBot will warn about it by performing “Final Warning” routine and stopping the game.

This Final Warning will contain:

- ❖ Sound and light effects performed in a higher tone and speed.
- ❖ An angry face showed in the LED matrix.
- ❖ The following warning messages appearing on the laptop screen: “You are TOO CLOSE to the screen”
“MOVE BACK!!”.
- ❖ A change of scenario for the game.



If the distance is longer than 40 cm, the game will continue and the mBot will remain steady.

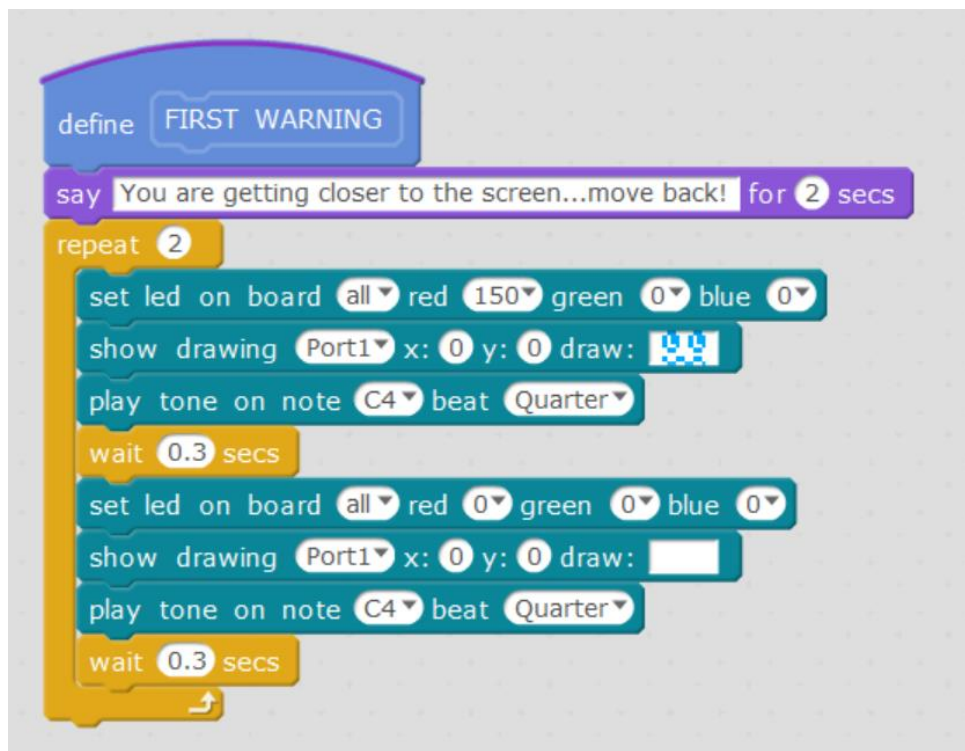
2. MAIN CODE OF THE ACTIVITY:



```
when clicked
  forever
    set Distance to ultrasonic sensor Port2 distance
    if Distance < 40 then
      if Distance > 25 then
        FIRST WARNING
      else
        FINAL WARNING
```

The main code starts with a 'when clicked' event. It enters a 'forever' loop. Inside the loop, it sets a variable 'Distance' to the value of an ultrasonic sensor at 'Port2'. Then, it checks if 'Distance' is less than 40. If true, it checks if 'Distance' is greater than 25. If true, it calls the 'FIRST WARNING' function. If false, it calls the 'FINAL WARNING' function. The loop then repeats.

3. FIRST WARNING CODE:



```
define FIRST WARNING
  say You are getting closer to the screen...move back! for 2 secs
  repeat 2
    set led on board all red 150 green 0 blue 0
    show drawing Port1 x: 0 y: 0 draw: [Warning]
    play tone on note C4 beat Quarter
    wait 0.3 secs
    set led on board all red 0 green 0 blue 0
    show drawing Port1 x: 0 y: 0 draw: [ ]
    play tone on note C4 beat Quarter
    wait 0.3 secs
```

The 'FIRST WARNING' function begins with a 'say' block that displays the message 'You are getting closer to the screen...move back!' for 2 seconds. It then enters a 'repeat' block that runs 2 times. In each iteration, it sets the LED on board to red (150), green (0), and blue (0). It then shows a drawing of a warning sign at 'Port1' with x: 0 and y: 0. Next, it plays a tone on note C4 with a quarter beat. It then waits for 0.3 seconds. After the wait, it sets the LED on board to all 0 (red, green, and blue). It then shows a drawing of a blank space at 'Port1' with x: 0 and y: 0. Finally, it plays a tone on note C4 with a quarter beat and waits for 0.3 seconds before the next iteration.

4. FINAL WARNING CODE:

```
define FINAL WARNING
  say You are TOO CLOSE to the screen for 2 secs
  say MOVE BACK!! for 1 secs
  repeat 3
    set led on board all red 150 green 0 blue 0
    show drawing Port1 x: 0 y: 0 draw: [Speaker]
    play tone on note C4 beat Quarter
    set led on board all red 0 green 0 blue 0
    show drawing Port1 x: 0 y: 0 draw: [Blank]
    play tone on note C4 beat Quarter
  switch backdrop to Game Over
  stop all
```

5. SCRATCH GAME CODE:



Beachball

```
when green flag clicked
  switch backdrop to boardwalk
  set Points to 0
  forever
    if touching Paddle? then
      change Points by 1
      play sound pop
      turn pick random 160 to 200 degrees
      move 10 steps
    if touching color red? then
      stop all

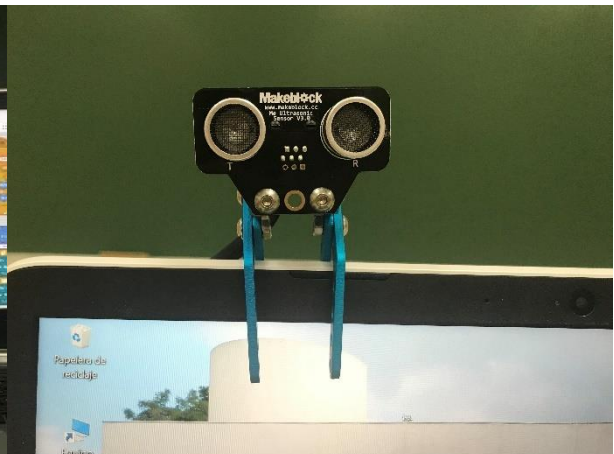
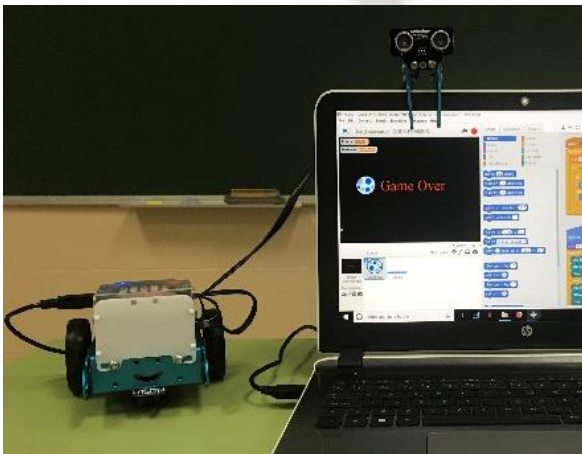
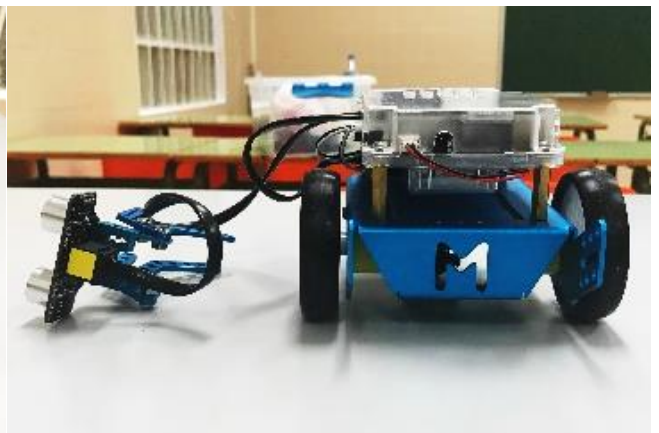
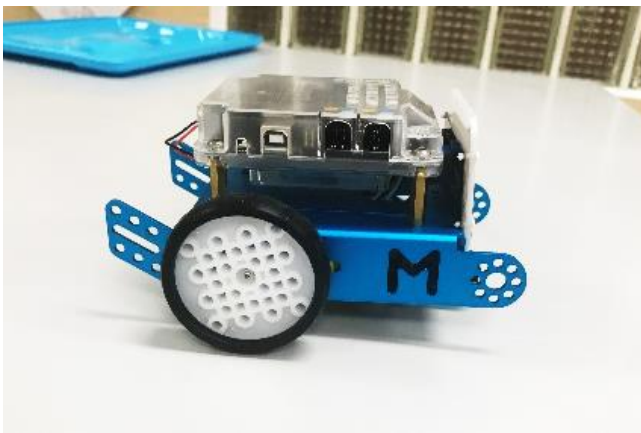
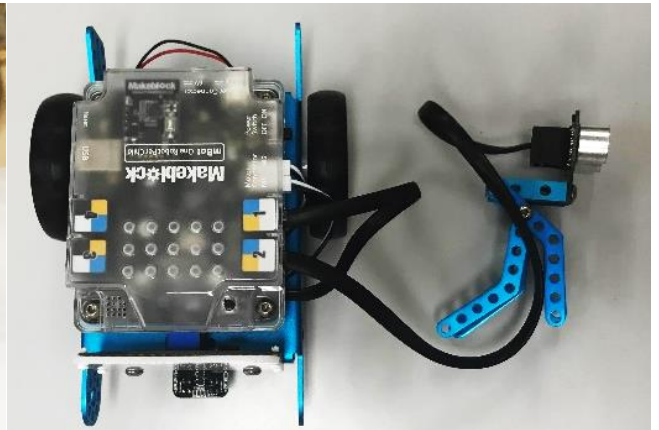
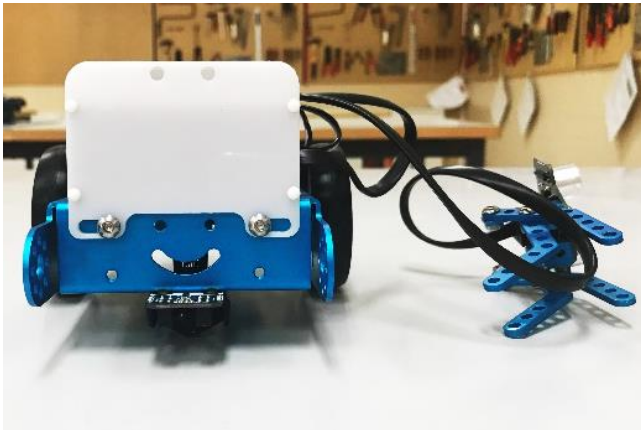
when green flag clicked
  go to x: 20 y: 160
  forever
    if on edge, bounce
    move 10 steps
```



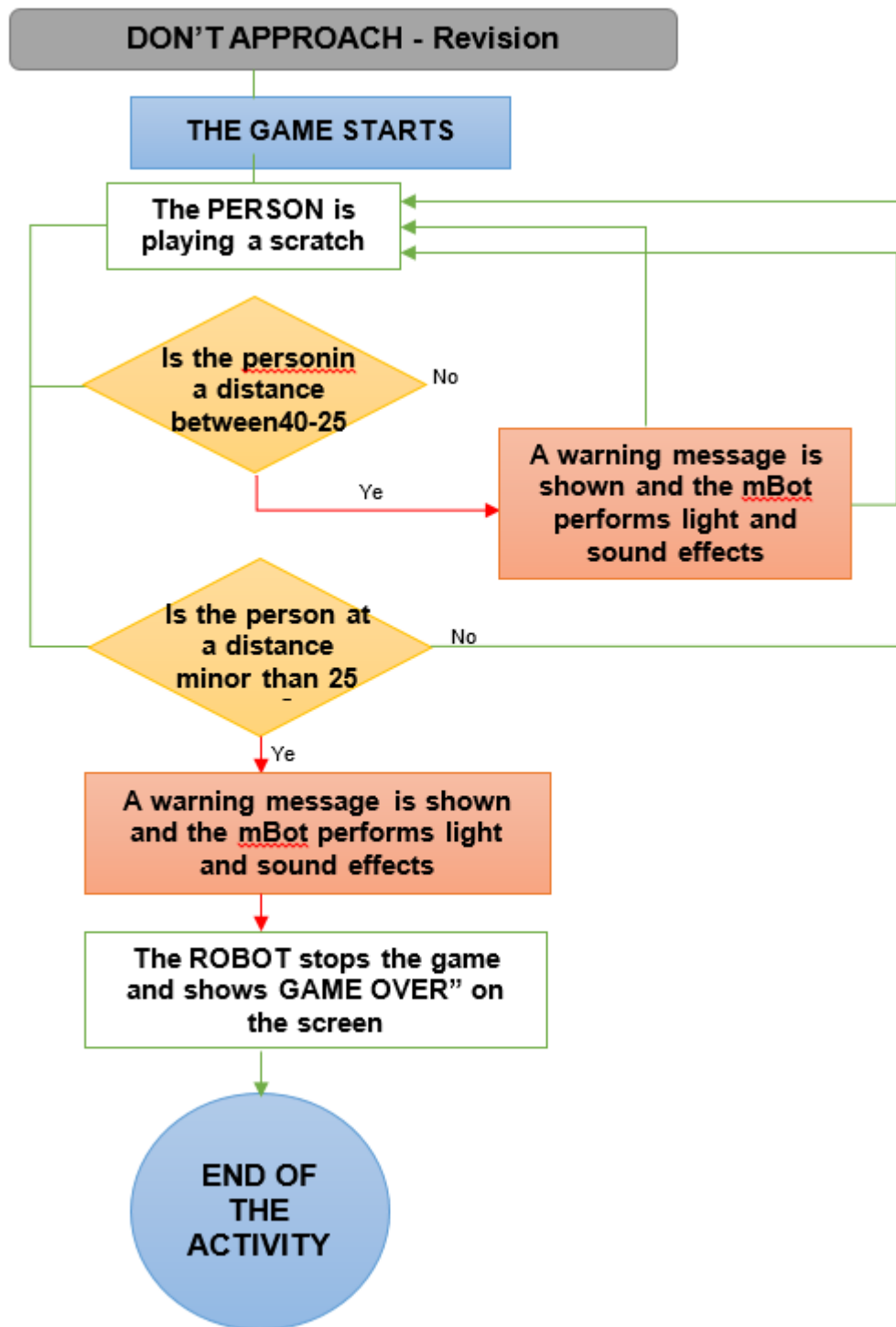
Paddle

```
when green flag clicked
  forever
    set x to mouse x
```

Once, the programming is finished, we start BUILDING UP THE STRUCTURE where all the mechanical elements will be set, just as the electronic elements.



FLOW CHART



STUDENTS' EVALUATION

The student's evaluation will be developed on the RUBRIC created specifically for the activity.

RESOURCES FOR USE MBOT

ELEMENT	ID	CABLE	AMOUNT	PORT 1			PORT 2			PORT 3				PORT 4				P.MOT1	P.MOT2
				Y	B	W	Y	B	W	Y	B	W	Bl	Y	B	W	Bl	W*	W*
Mbot Robot 2'4G			1																
Motor 1	W*																W*		
Motor 2	W*																W*		
Ultrasonic sensor	Y	1	1				Y												
Matriz de LEDs	B	1	1		B														
RJ25 cables			4																
Structures																			
	Support P1		2																
	Plate 45°		4																
Laptops			1																
Atrezzo (not essential)			X																