

# TRAIN PASSING



## STEMJAM Teaching Guide

Developing make spaces to promote creativity  
around STEM in schools

Acronym: STEMJAM

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# TRAIN PASSING

## ABSTRACT

This activity will create a level crossing of a train using the mBot.

## DIDACTIC OBJECTIVES

### TECHNOLOGY

- ❖ Develop the code for the barrier.

### ENGINEERING

- ❖ Construct the system with Arduino and the barrier's house.

STEM Subject:    Science             Technology             Engineering             Mathematics

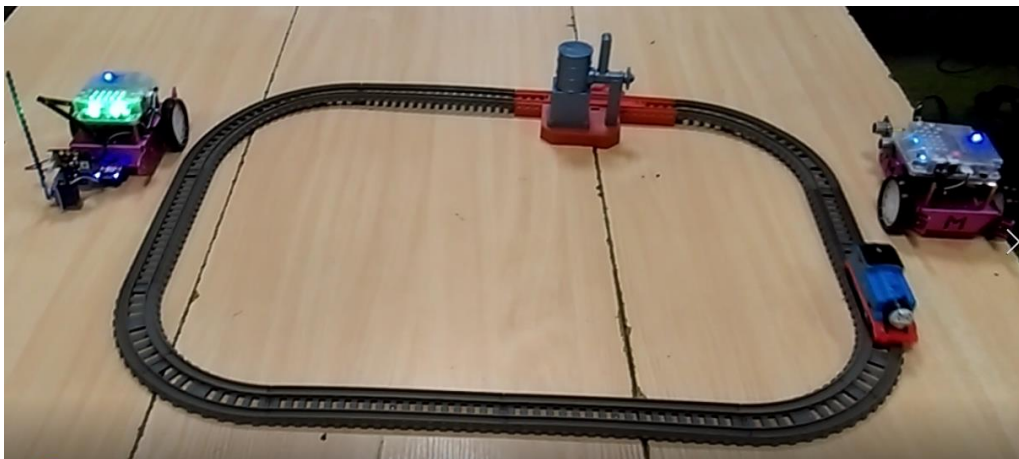
Education Level:            12-14 years             14-16 years

## PROBLEM STATEMENT

The activity consist of two part:

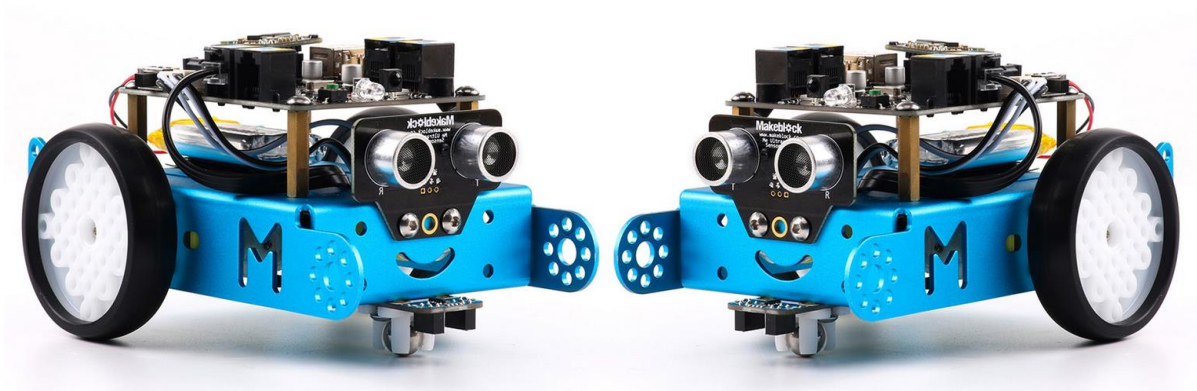
1. Communication between robots.
2. Using servomotor.

The task is building the model of rail with passage for cars. The train drives the trucks. First robot uses the ultrasonic sensor to detect the train. When the train is in front of the sensor the robot send the message to second robot. The second robot after it received the message puts the barrier down. After passing the train the barrier goes up.



## BOM (Bill of Materials Needed)

- (x2) mBot => Ref. 90054



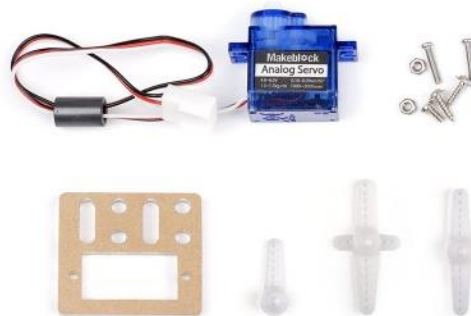
- ❖ Different beams and structures:



- ❖ Me Ultrasonic Sensor:



- ❖ 9g Micro Servo Pack:



- ❖ The toy rail and locomotive (or third mBot that follow black line).

## ACTIVITY DESCRIPTION

### Step 1. Communication between robots:

Robot – transmitter sends the message using IR. The message is sending after pressing the key on PC keyboard. Later we can change the situation: the message is sending when sensor give us specified value.

Robot – receiver after received the message moves or turns the light on (set leds on board).

### Stage 2. Servomotor instalation:

Students install servomotor to mBot. They can used the instruction included by producer or make their own project. Student write simple program to check the servo and learn how to control it. It is important to note the number of port, the slot and angle value. The angle value depends of construction of robot. It is the number between 0 and 180.

### Stage 3. Final:

Robot transmitter after observing the train give the signal “stop”.

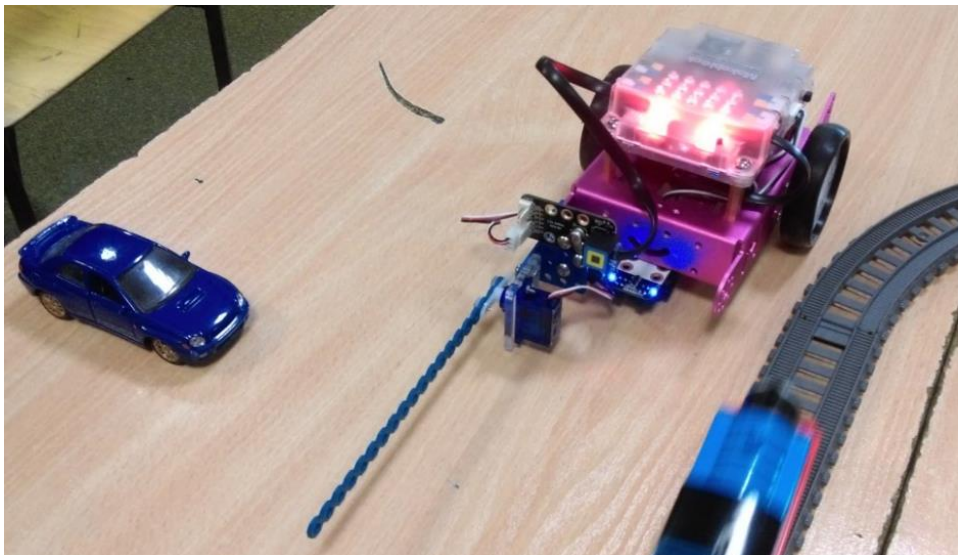
Robot receiver change the position of barrier and set the led to red colour – it stops the car.

The time of reaction depend of length of truck. Students can use stopper to measure the time.

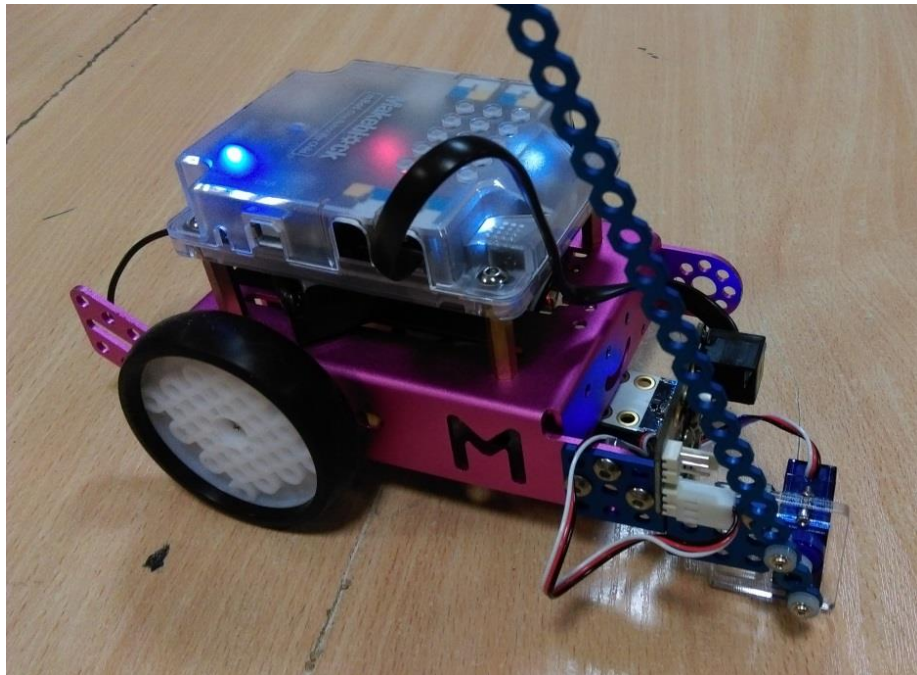
### TIP:

Robot transmitter should have the leds off, because the light of leds interferes with the signal

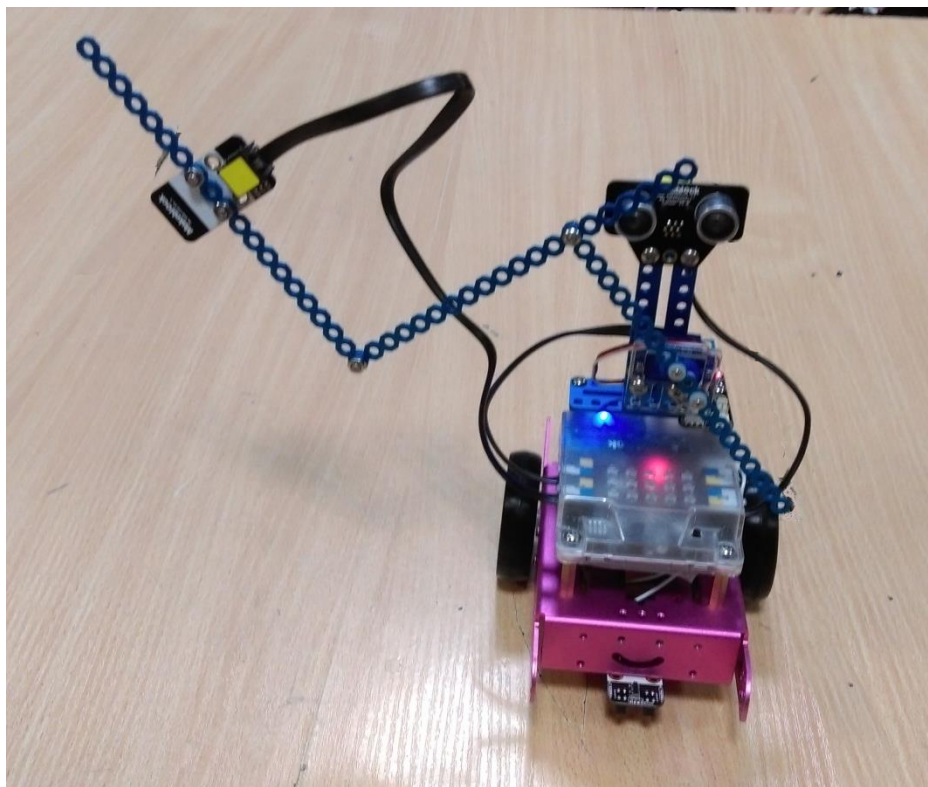
The barrier is down, when the train is passing.



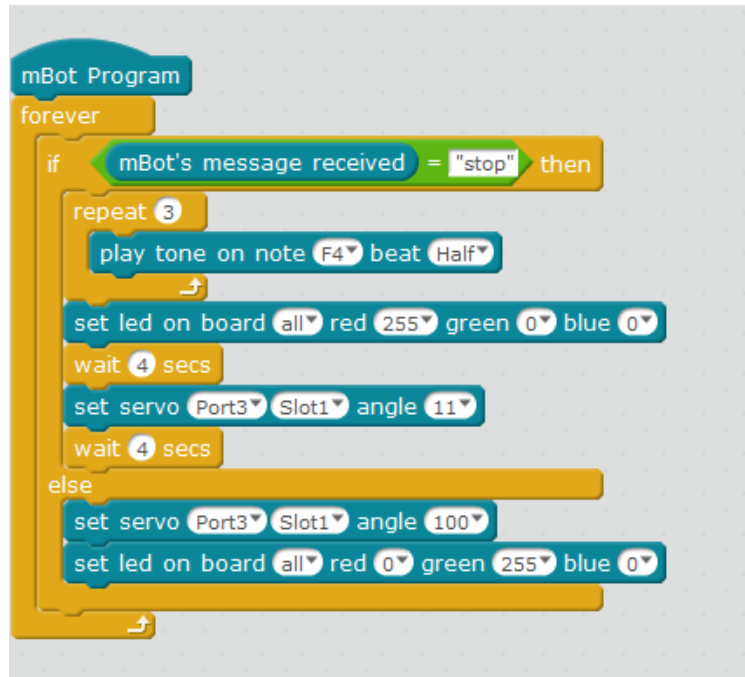
The example of mounting the servo with barrier (the students' idea).



The example of mounting the servo with barrier (student follow the instruction)



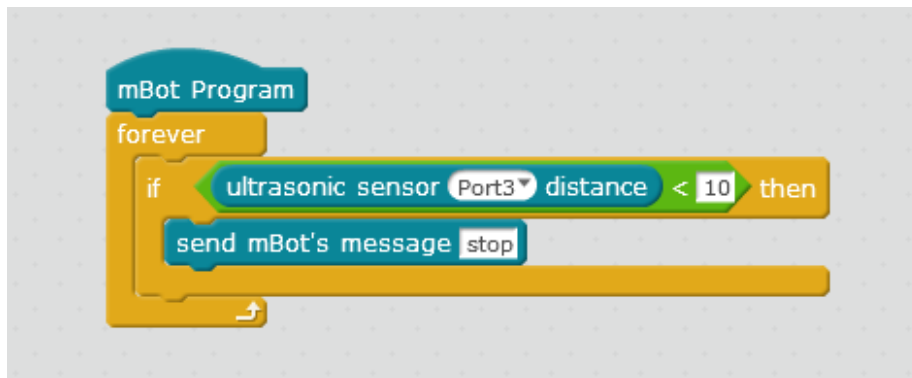
The program to robot receiver:



```
mBot Program
forever
  if mBot's message received = "stop" then
    repeat 3
      play tone on note F4 beat Half
    set led on board all red 255 green 0 blue 0
    wait 4 secs
    set servo Port3 Slot1 angle 11
    wait 4 secs
  else
    set servo Port3 Slot1 angle 100
    set led on board all red 0 green 255 blue 0
```

TIP: the text stop should be in quotation marks.

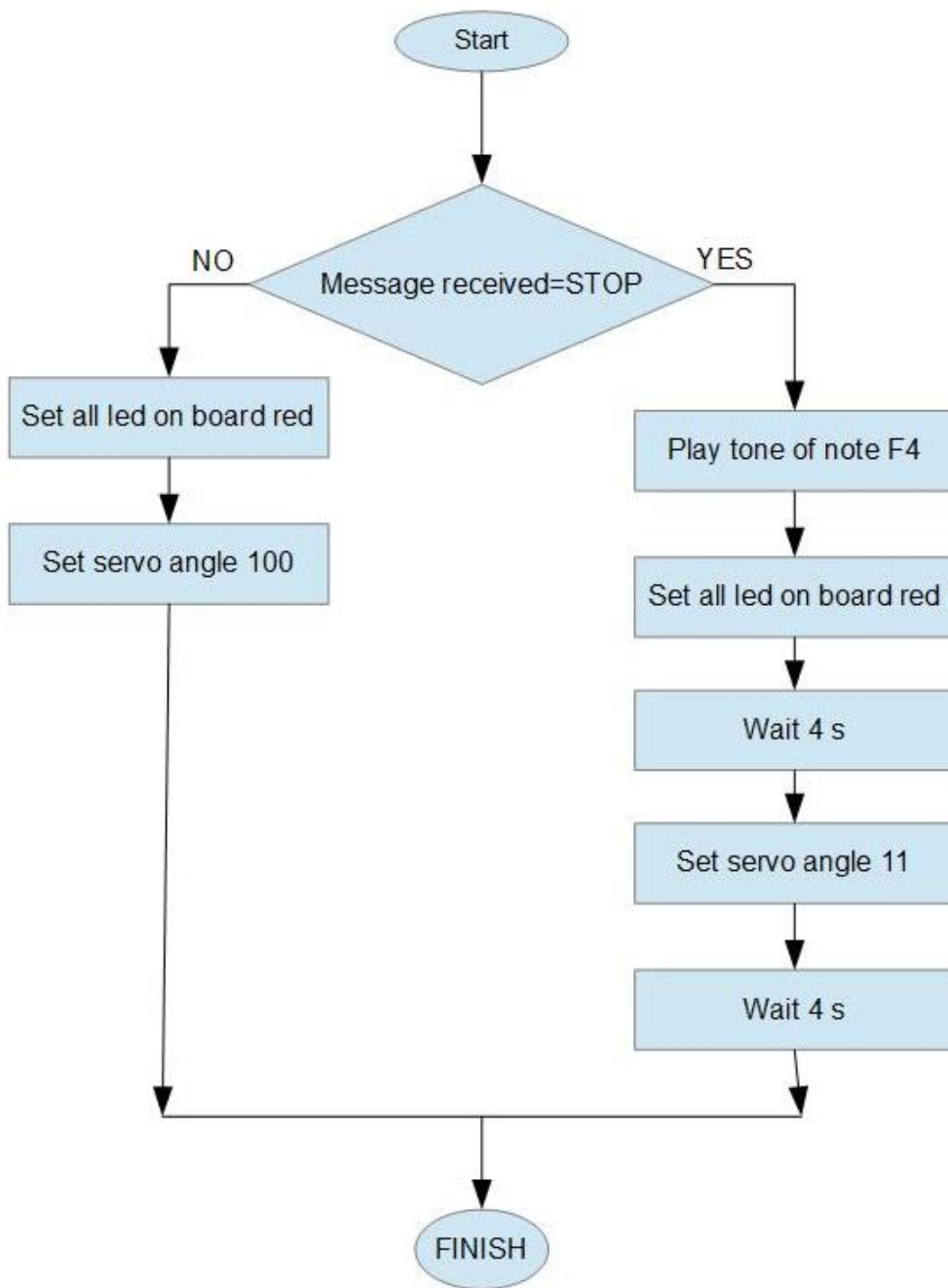
The program to robot transmitter:

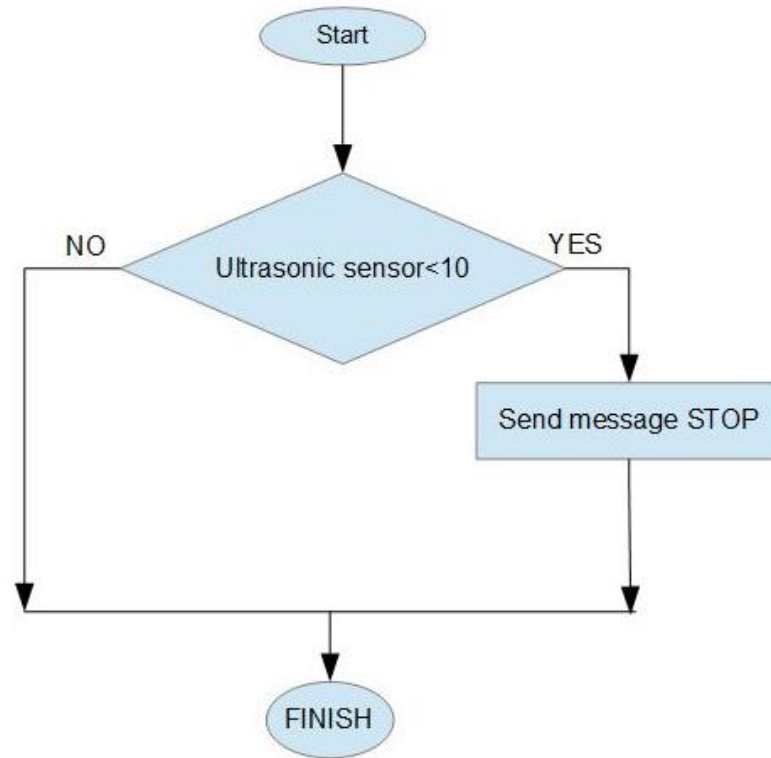


```
mBot Program
forever
  if ultrasonic sensor Port3 distance < 10 then
    send mBot's message stop
```

TIP: the text stop without quotation marks.

# FLOW CHART





### STUDENT'S EVALUATION

Student can use communication between robots, the message is string type.

Student can use servo. They changes the position by setting the angle.

### SCALABILITY

The activity is for student who know if instruction.

In this version you use only mBots, instead of Arduino Boards, so it is easier to do it in class.

