SHALL WE DANCE

STEMJAM Teaching Guide

Developing make spaces to promote creativity around STEM in schools

Acronym: STEMJAM
Project no. 2016-1-ES01-KA201-025470

www.stemjam.eu

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SHALL WE DANCE

ABSTRACT

The idea is to promote the learning of music through gamification and robotics.

The activity will consist of creating and coding a "choreography" for the music of the film “flash dance”. It will be played by a mBot.

In first place, it will be necessary to understand some contents of music: types of notes, their duration and the meaning of some musical symbols.

Then, once the song has been chosen, every single note will have to be coded so that the mBot will play the song as if it was a musician.

On the other hand, taking into account the duration of the different notes that form the song, a dance will be devised, where each movement will be designed according to the notes. The dance will also be accompanied by lighting effects.

For the second version, “Lets Play Music”, we need two arduino cards for musicplayer. The ultrasonic sensor connects to the card switches between music. We will decrease or increase the volume of the music with potentiometer. In addition, we will show on the screen the play / stop, the decrease / increase of the volume.

Important Note: To give basic electronic information to students; cables, pins, cards; Arduino card has been used in our project to ensure that circuits are built. It is targeted to use Raspberry Pi in later stages of the project.

- Phase 1: The process of working with mBot and mBlock.
- Phase 2: Arduino and mblock-S4a work process
- Phase 3: Raspberry Pi working process (Project students must be at least 8th grade)

DIDACTIC OBJECTIVES

GENERAL ISSUES:

- Know how to use the free sensor as motion sensor.
- Knowing to add music from outside to S4.
- Knowing how to control over-arduino card.

TECHNOLOGY:

- Introduction to computational thinking.
- Assimilation, creation and programming of algorithms, to decompose complex problems into ordered sequences of simple instructions, which solve it.

ENGINEERING and SCIENCE:

- Design of structures:
  - Stability: concepts of inertia and center of gravity.
  - Choice of the most suitable structure for the assembly of the chosen components and sensors.
  - Assembly of the structure.

OTHERS:

- To acquire motivation for the study and understanding of the contents of other areas than STEM areas, such as MUSIC or DANCE.
- Learning to work and cooperate in a group.

STEM Subject: Science☐ Technology ☒ Engineering☐ Mathematics☐

Education Level: 12-14 years☒ 14-16 years☒

PROBLEM STATEMENT

The mBot robot has to be programmed to work altogether with the laptop, by creating the operations' algorithms and the resultant effects. This way, when the students calculate the answer to one equation, there is a specific effect on the robot and so there is in the race.

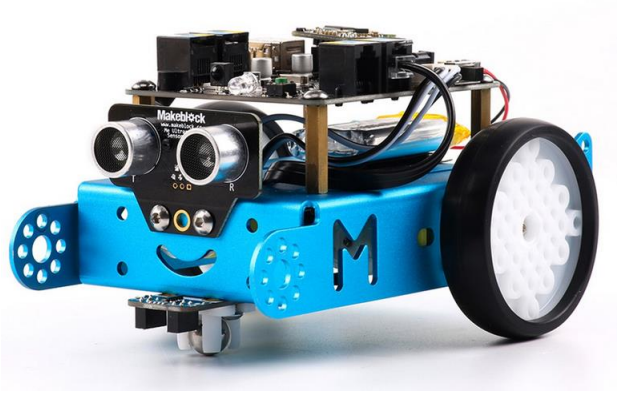
To build a robot to make a competition between two teams. Thinking about difficulties of maths operations. The basic one is for children at the beginning of primary school. Next you can make the problem more complex - add devision with rational result. At the end – solving linear equation.

On reviewed version:

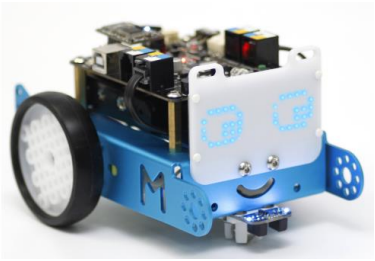
1. You need a remote to change music
2. Need to be close to music player to change music

BOM (Bill of Materials Needed)

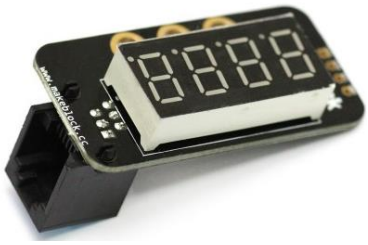
- (x2) mBot => Ref. 90054



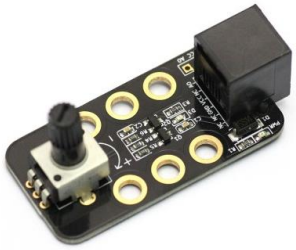
- Me **LED Matrix 8 × 16**:



- Me **7-Segment Serial Display - Red**:



- Me **Potentiometer**:



- Me **Ultrasonic Sensor**:

- (x5) Cables RJ25.
- (x2) Arduino shileds.
- Music and visual files to be loaded into the application.
- Rest of Attrezzo (not essential)

First version

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*
Me 7-Segment serial display	B		1								B								
Me Led Matrix 8x16	B		1		B														
RJ25 cables			2																
Structures and beams			Several																
Laptops			1																
Attrezzo (not essential)			X																

Second version

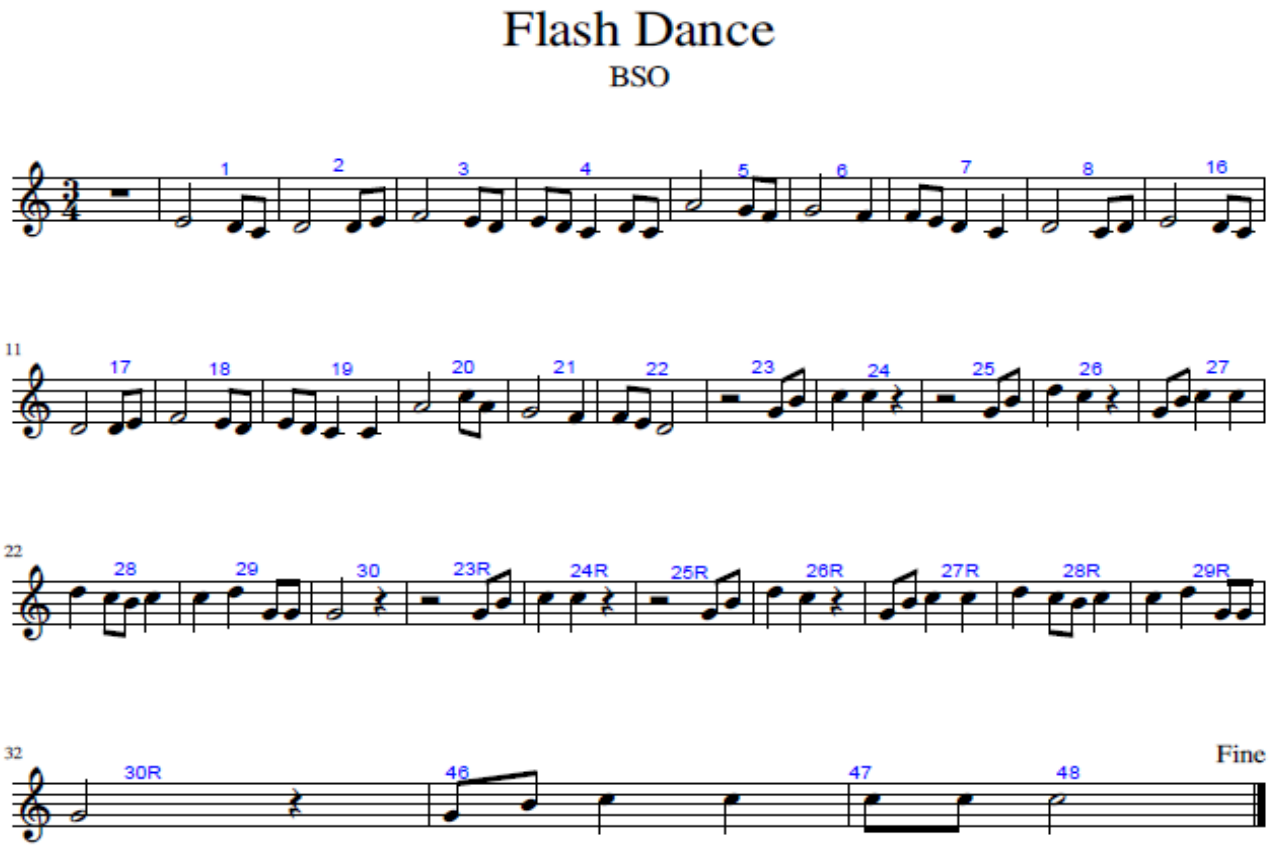
ELEMENT	ID	CABLE	AMOUNT	PORT 1			PORT 2			PORT 3				PORT 4				P.MOT1	P.MOT2
				Y	B	W	Y	B	W	Y	B	W	Bl	Y	B	W	Bl	W*	W*
Mbot Robot 2´4G			1																
Motor 1	W*																	W*	
Motor 2	W*																		W*
Me Led Matrix 8x16	B		3		B			B							B				
RJ25 cables			3																
Structures and beams			Several																
Laptops			1																
Attrezzo (not essential)			X																

First Version

This activity consists of coordinating the music a mBot plays, with the dance other mBot performs.

To achieve this goal, students will have to decide how to split the sheet music in small pieces. They will have to design, in a coordinated way, what both mBots (musician and dancer) do for every single cut, for every single beat.

Together with the music teacher, we studied the original sheet music and we decided to shorten it so that it was not too long. In the image below, you can see it shortened. This is the one we have coded.



The same numbers written above the beats, are the ones written at the right of the lines of the code.

Before starting to code its beat, it must be translated into the system of notes by letters, (the one used by MBlock):

Do	C
Re	D
Mi	E
Fa	F
Sol	G
La	A
Si	B

For all the programming, we will use MBlock software. We can download it at MBlock´s page: http://www.mblock.cc/download/ .

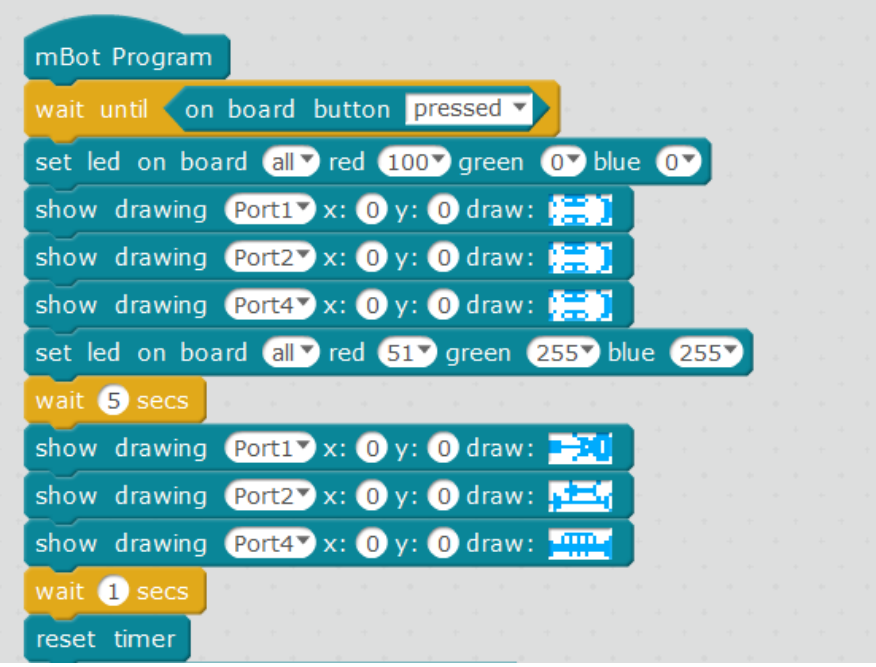
Once the software is installed, it can be paired with MBot by using the 2.4G Wireless Serial Port. But in this activity is rather better to upload the code to the mCore board (both codes, musician and dancer).

After all these technical tasks, we start with the PROGRAMMING.

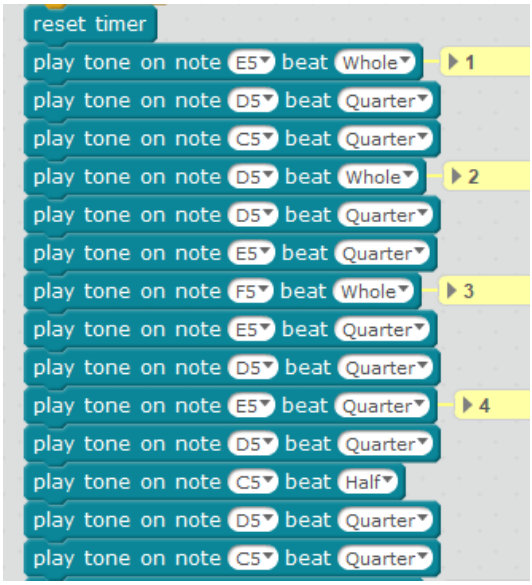
MUSICIAN CODE:

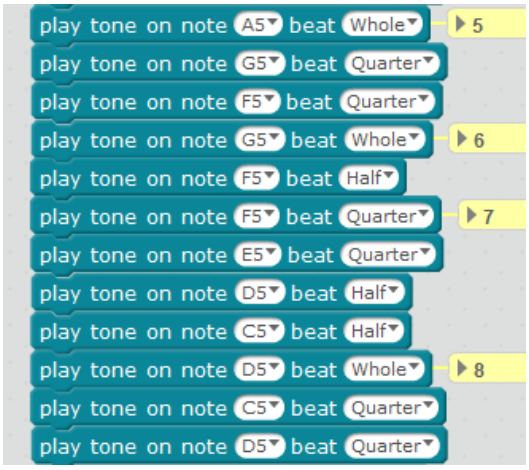
1. INTRODUCTION PART OF THE PROGRAM:

As the program is uploaded in the mCore board, it will not start unless we press the on board button. As soon as we press it, the musicians will greet and show their instruments (by using the Led Matrix). After, the timer will reset.

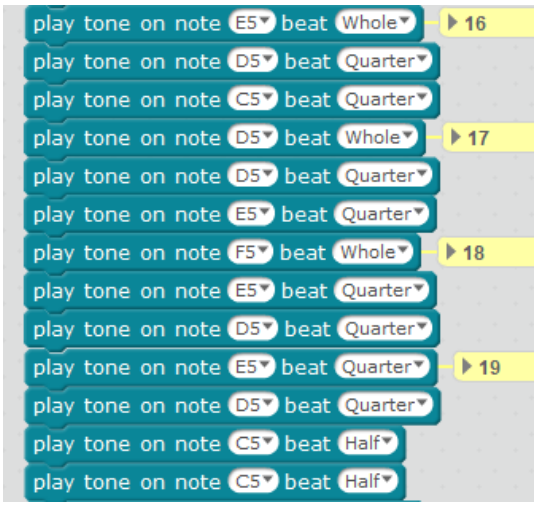


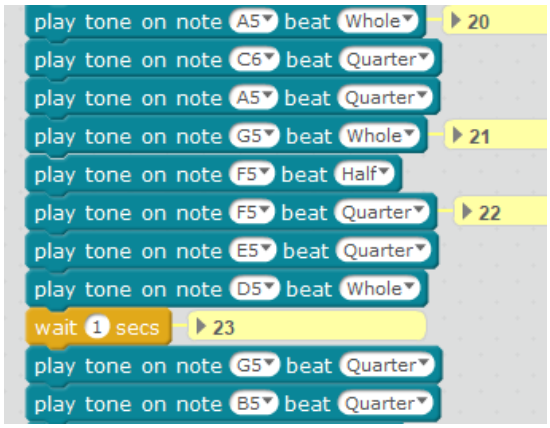
2. CODING THE MUSIC (from 1-8 beats):

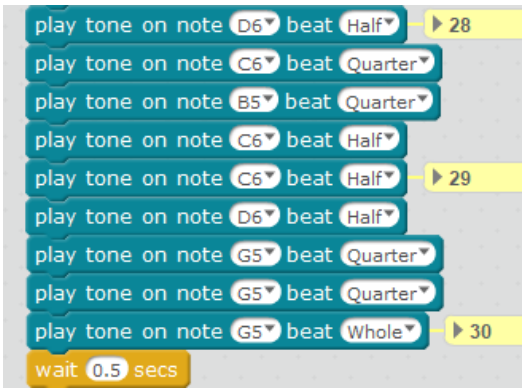




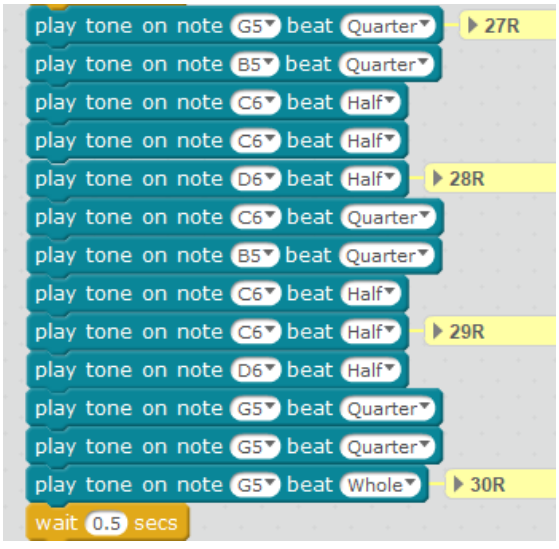
3. CODING THE MUSIC (from 16-30 beats):



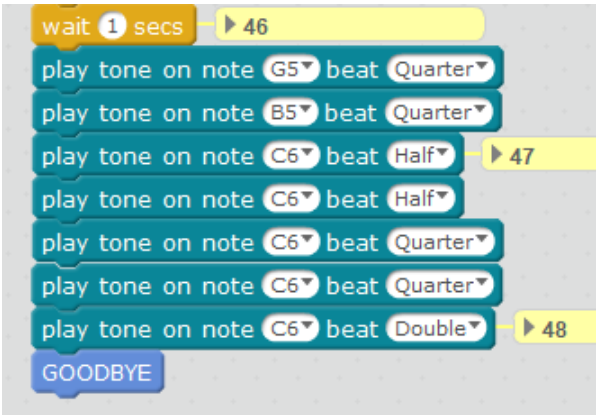




4. CODING THE MUSIC (from 23R-30R beats):

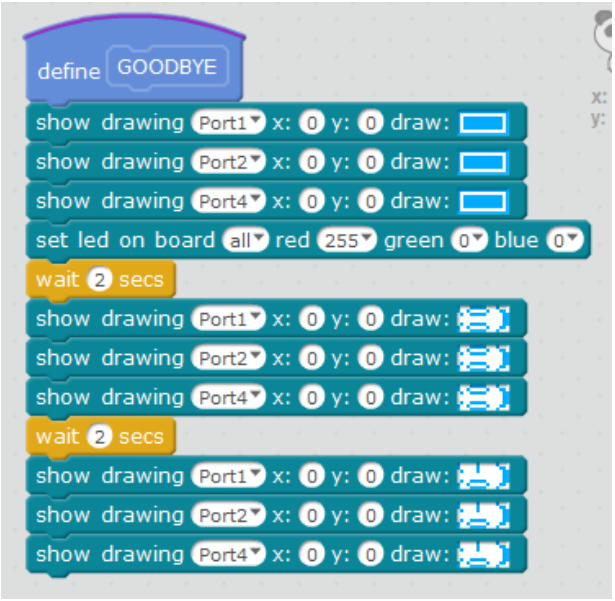


5. CODING THE MUSIC (from 46-48 beats):



6. GOODBYE Routine:

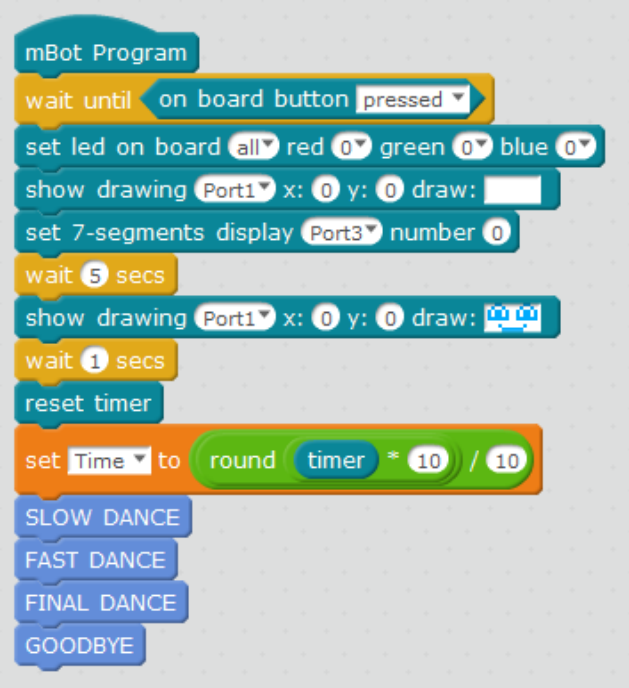
Once the music is finished, the leds on board turn on red and the musicians say goodbye with a wink.



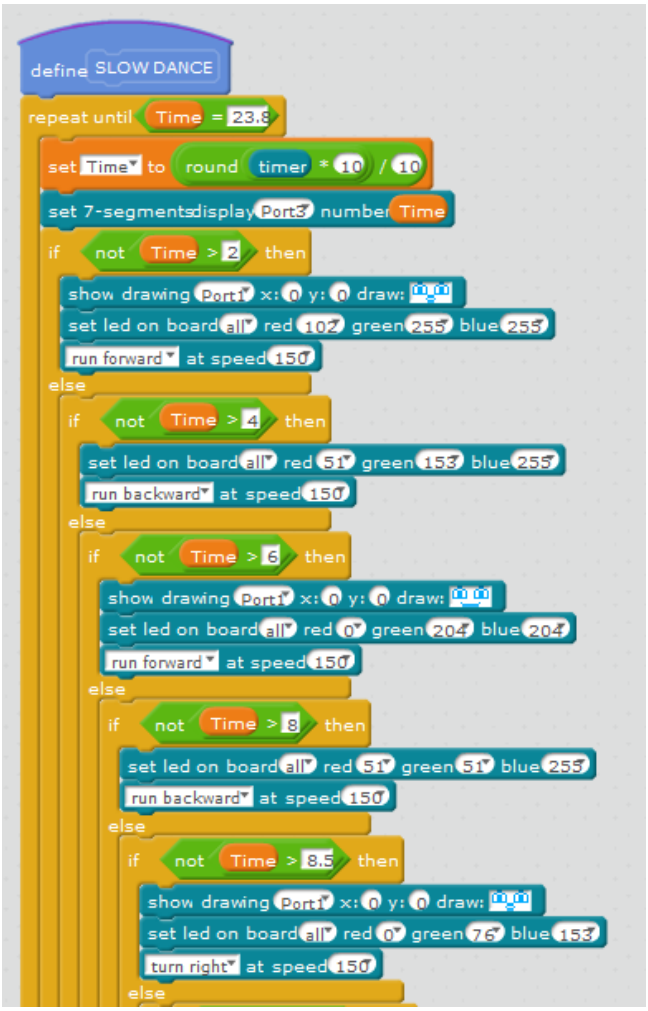
DANCER CODE:

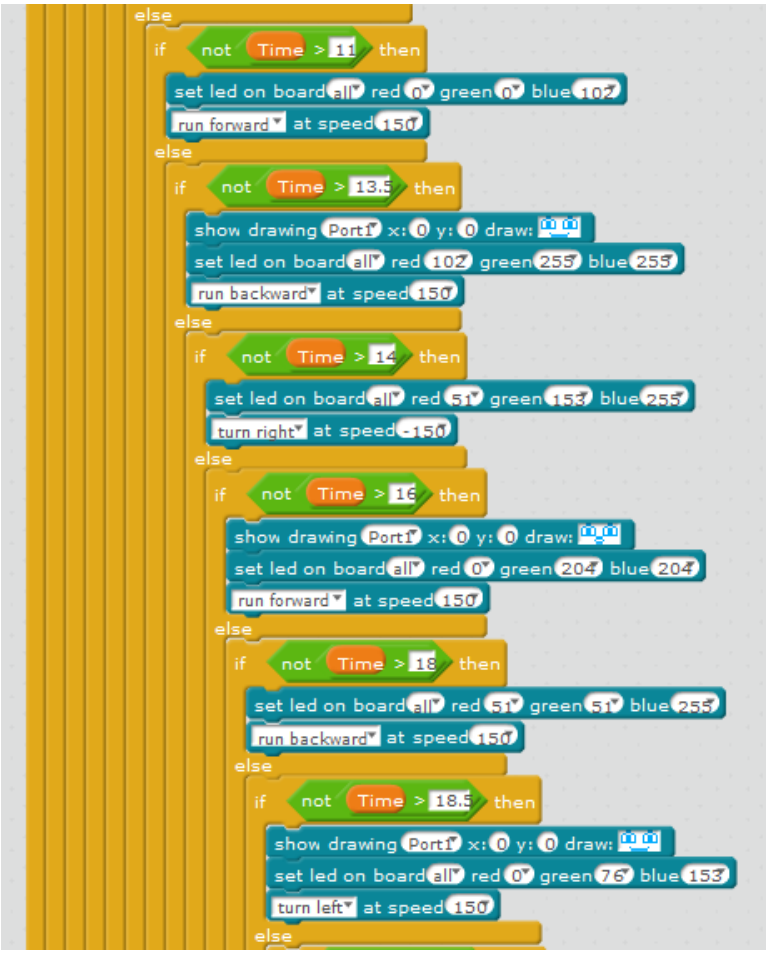
1. INTRODUCTION PART OF THE PROGRAM:

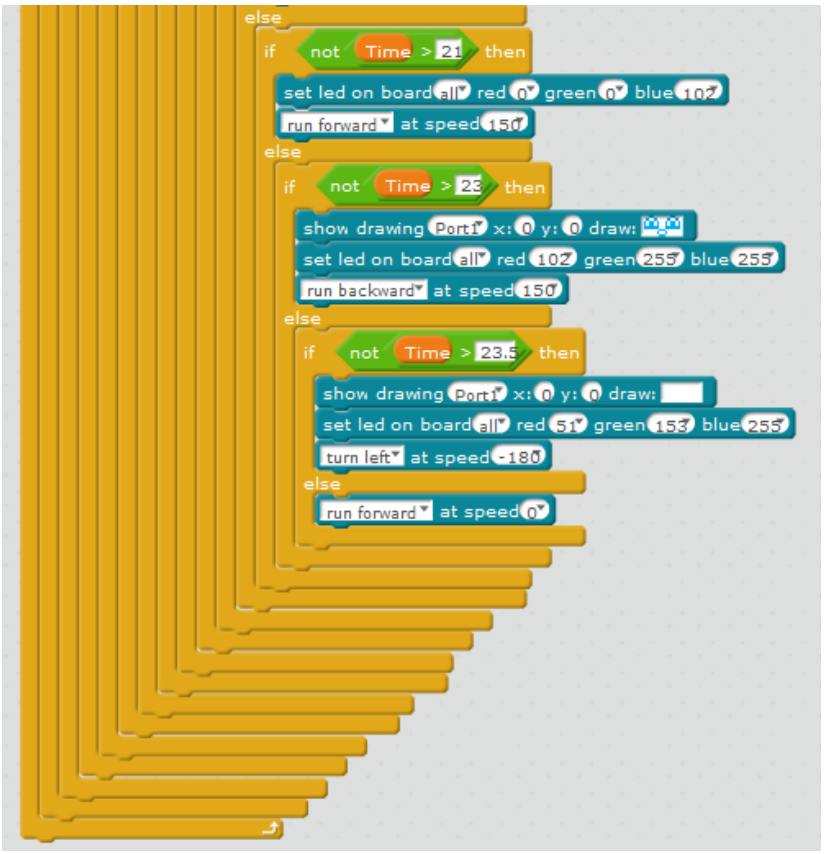
As the program is uploaded in the mCore board, it will not start unless we press the on board button. As soon as we press it, the dancer will greet and the timer will reset. After that, the dancing will take place in three stages: slow dance – fast dance – final dance.



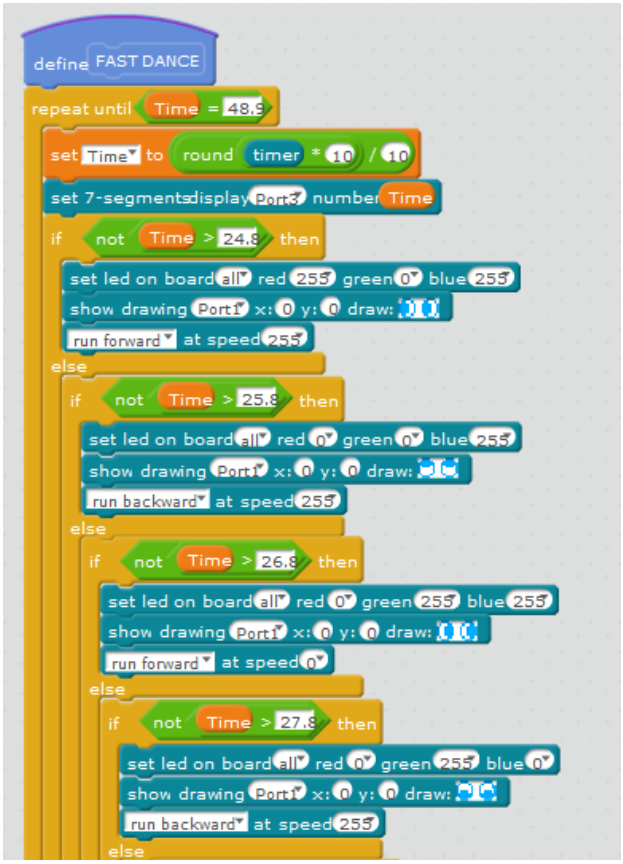
2. <u>DANCING PART – SLOW DANCE</u>:

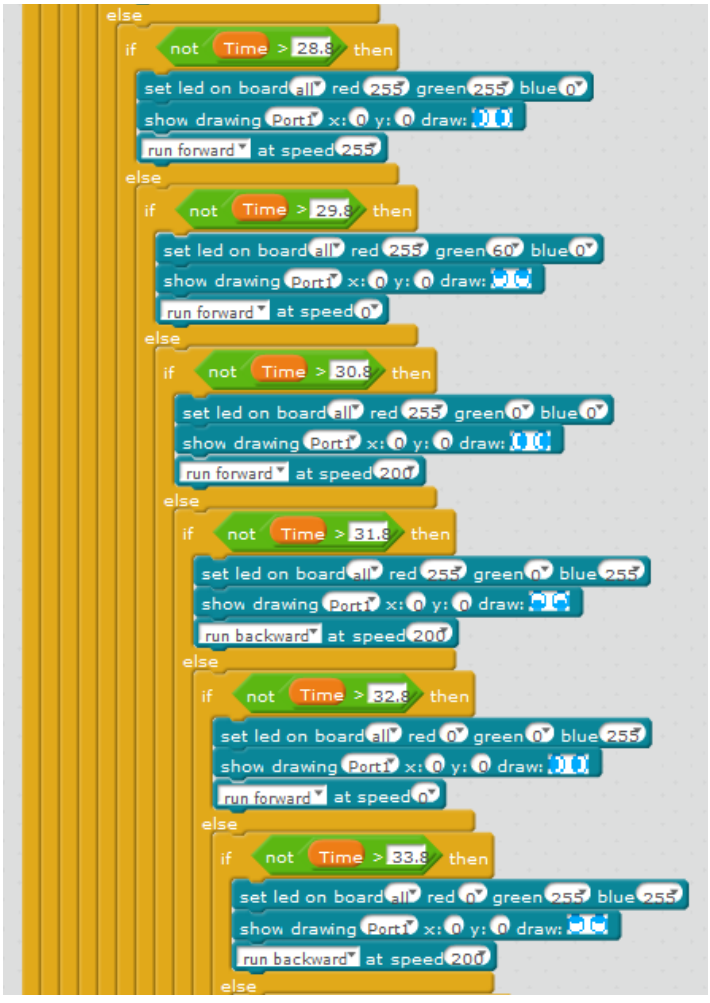


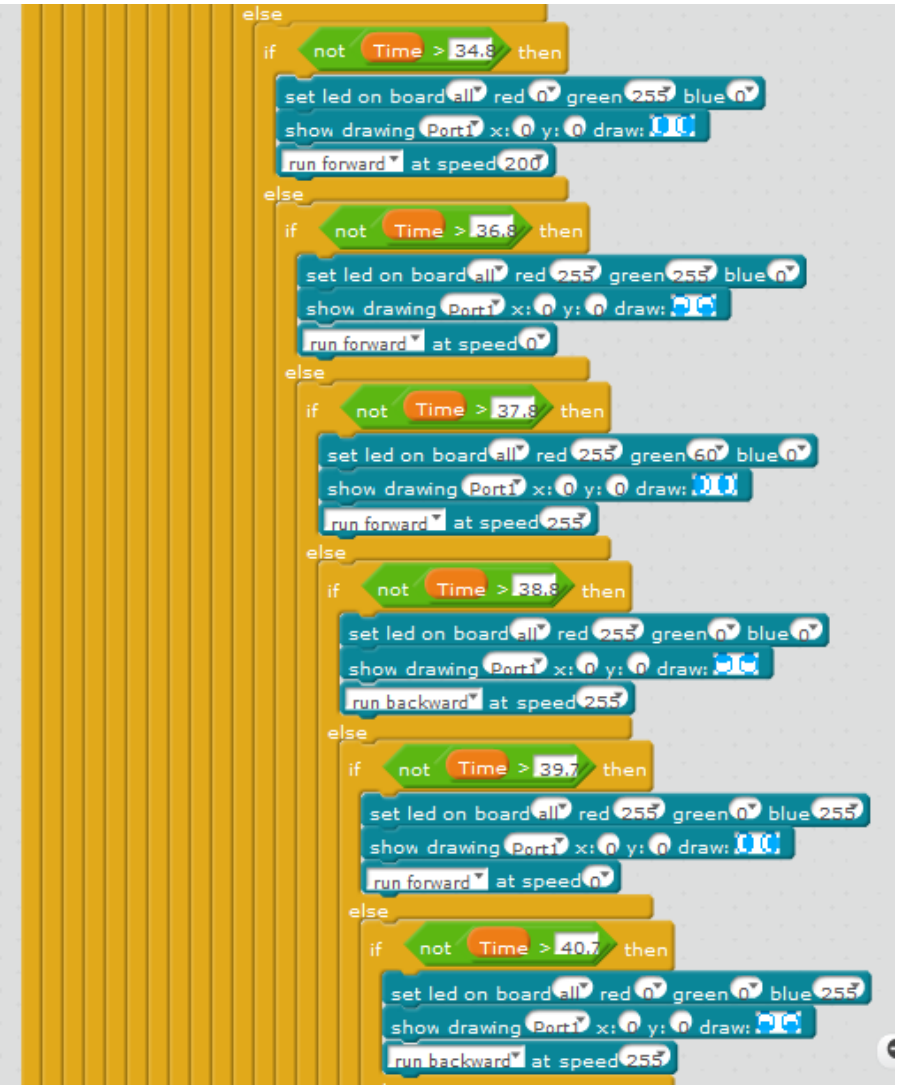

else
if not Time > 11 then
set led on board all red 0 green 0 blue 102
run forward at speed 150
else
if not Time > 13.5 then
show drawing Port1 x: 0 y: 0 draw:
set led on board all red 102 green 255 blue 255
run backward at speed 150
else
if not Time > 14 then
set led on board all red 51 green 153 blue 255
turn right at speed -150
else
if not Time > 16 then
show drawing Port1 x: 0 y: 0 draw:
set led on board all red 0 green 204 blue 204
run forward at speed 150
else
if not Time > 18 then
set led on board all red 51 green 51 blue 255
run backward at speed 150
else
if not Time > 18.5 then
show drawing Port1 x: 0 y: 0 draw:
set led on board all red 0 green 76 blue 153
turn left at speed 150
else

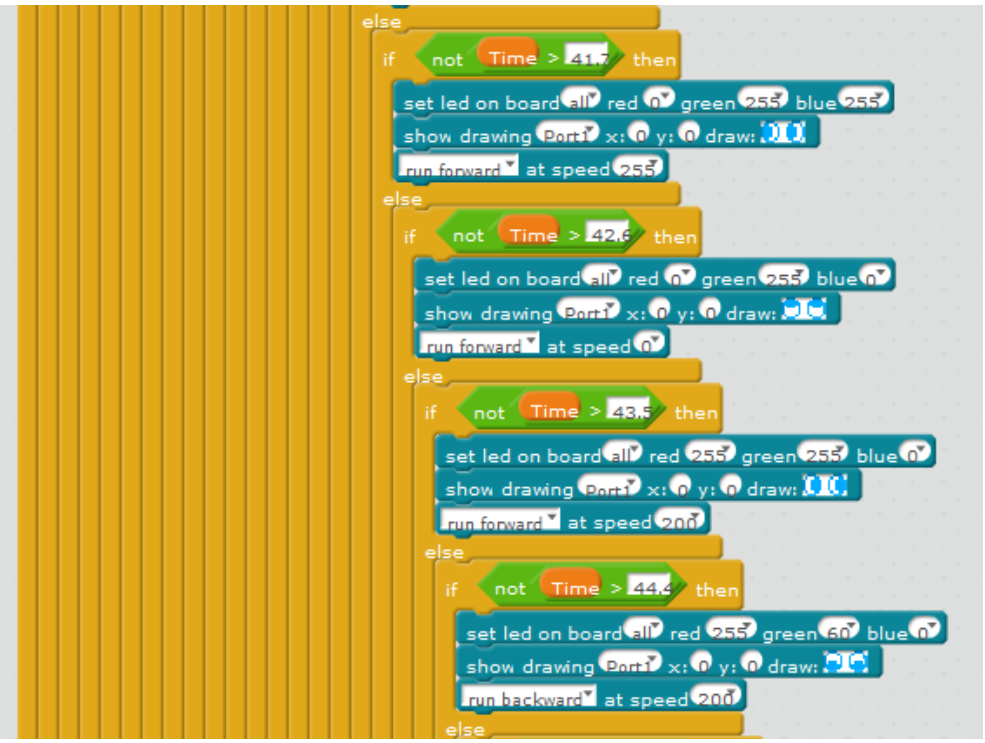

else
if not Time > 21 then
set led on board all red 0 green 0 blue 102
run forward at speed 150
else
if not Time > 23 then
show drawing Port1 x: 0 y: 0 draw:
set led on board all red 102 green 255 blue 255
run backward at speed 150
else
if not Time > 23.5 then
show drawing Port1 x: 0 y: 0 draw:
set led on board all red 51 green 153 blue 255
turn left at speed -180
else
run forward at speed 0

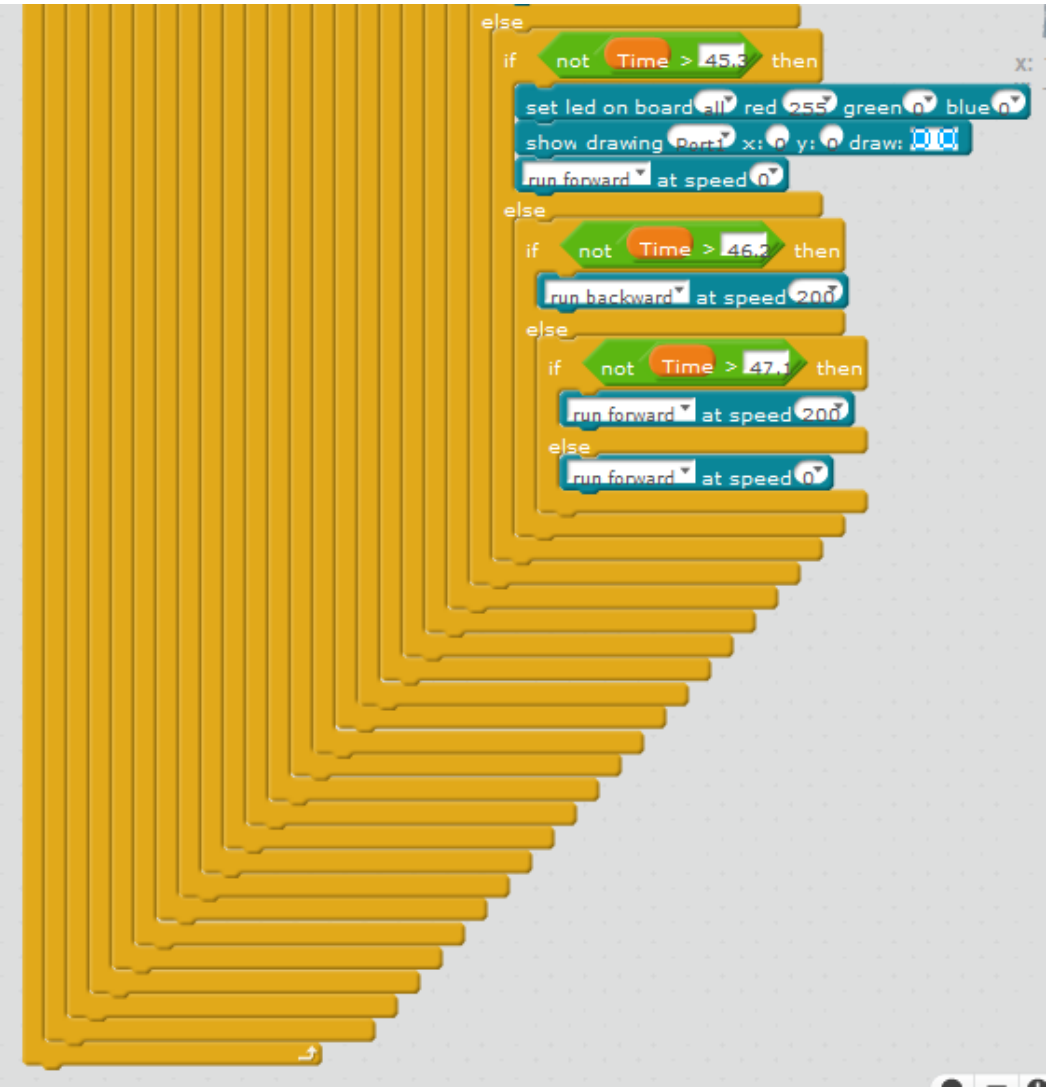
3. DANCING PART – FAST DANCE:



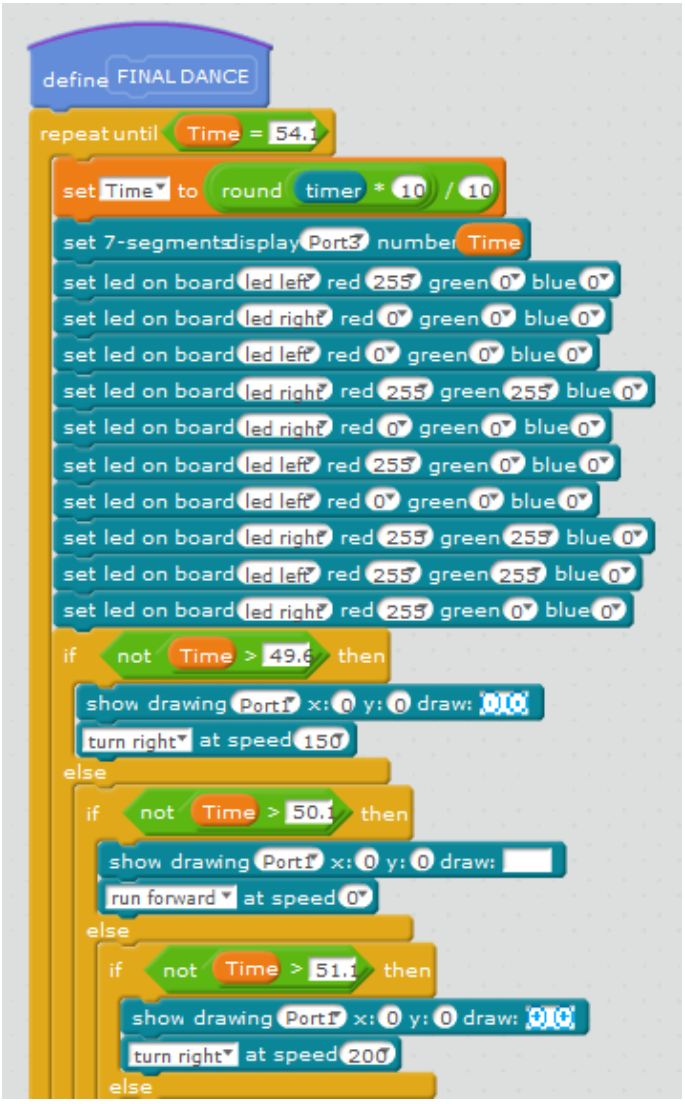


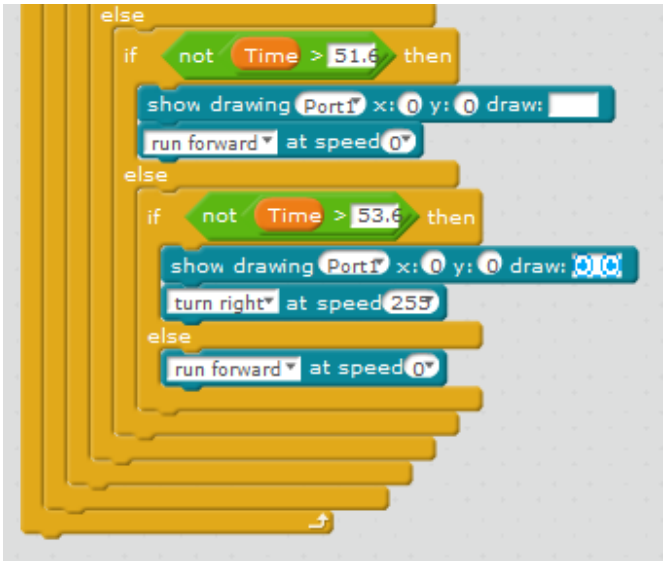

else
if not Time > 34.8 then
set led on board all red 0 green 255 blue 0
show drawing Port1 x: 0 y: 0 draw:
run forward at speed 200
else
if not Time > 36.8 then
set led on board all red 255 green 255 blue 0
show drawing Port1 x: 0 y: 0 draw:
run forward at speed 0
else
if not Time > 37.8 then
set led on board all red 255 green 60 blue 0
show drawing Port1 x: 0 y: 0 draw:
run forward at speed 255
else
if not Time > 38.8 then
set led on board all red 255 green 0 blue 0
show drawing Port1 x: 0 y: 0 draw:
run backward at speed 255
else
if not Time > 39.7 then
set led on board all red 255 green 0 blue 255
show drawing Port1 x: 0 y: 0 draw:
run forward at speed 0
else
if not Time > 40.7 then
set led on board all red 0 green 0 blue 255
show drawing Port1 x: 0 y: 0 draw:
run backward at speed 255


else
if not Time > 41.7 then
set led on board all red 0 green 255 blue 255
show drawing Port1 x: 0 y: 0 draw:
run forward at speed 255
else
if not Time > 42.6 then
set led on board all red 0 green 255 blue 0
show drawing Port1 x: 0 y: 0 draw:
run forward at speed 0
else
if not Time > 43.5 then
set led on board all red 255 green 255 blue 0
show drawing Port1 x: 0 y: 0 draw:
run forward at speed 200
else
if not Time > 44.4 then
set led on board all red 255 green 60 blue 0
show drawing Port1 x: 0 y: 0 draw:
run backward at speed 200
else


else
if not Time > 45.3 then
set led on board all red 255 green 0 blue 0
show drawing Port1 x: 0 y: 0 draw: DOT
run forward at speed 0
else
if not Time > 46.3 then
run backward at speed 200
else
if not Time > 47.3 then
run forward at speed 200
else
run forward at speed 0

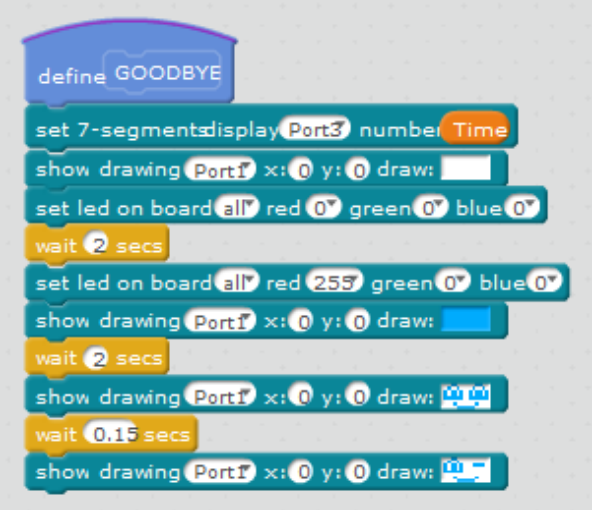
4. DANCING PART – FINAL DANCE:



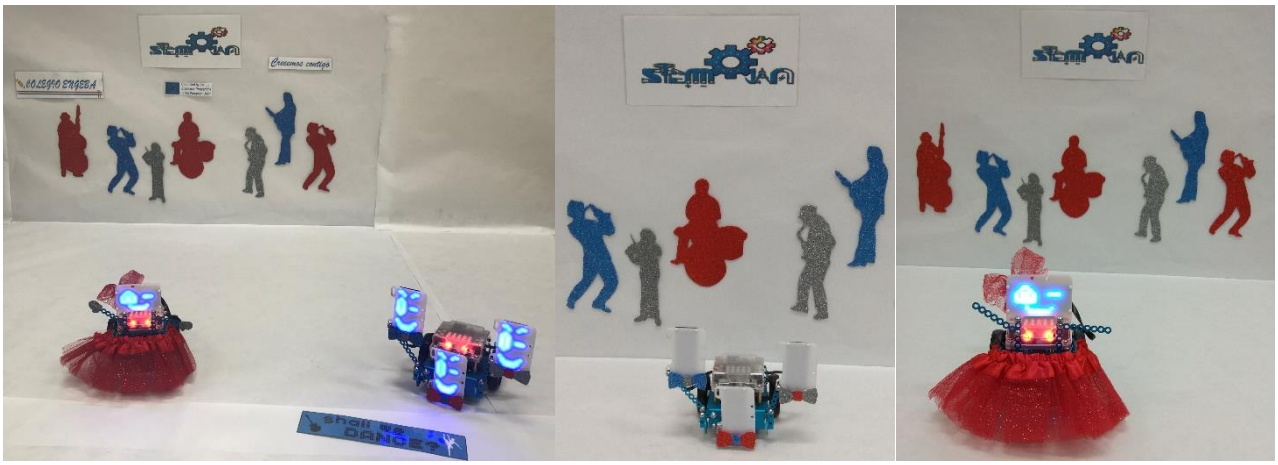


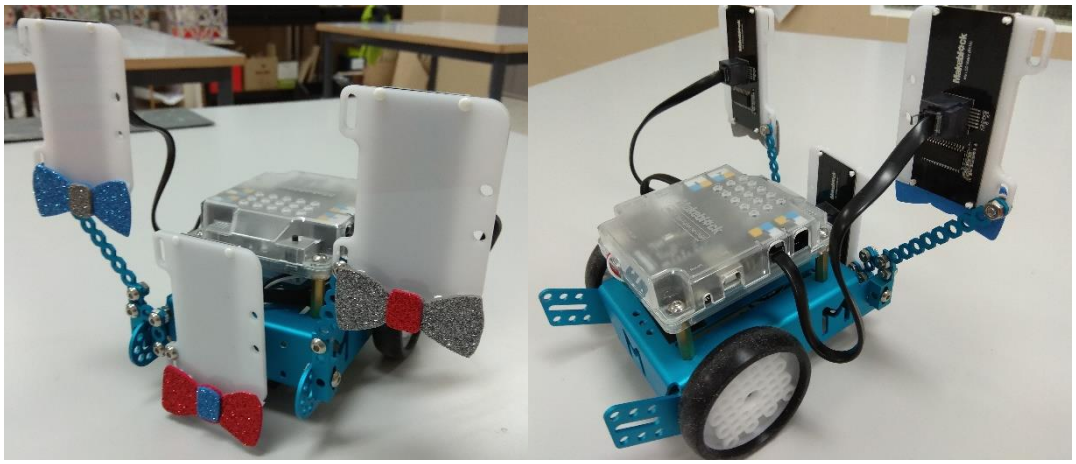
5. GOODBYE Routine:

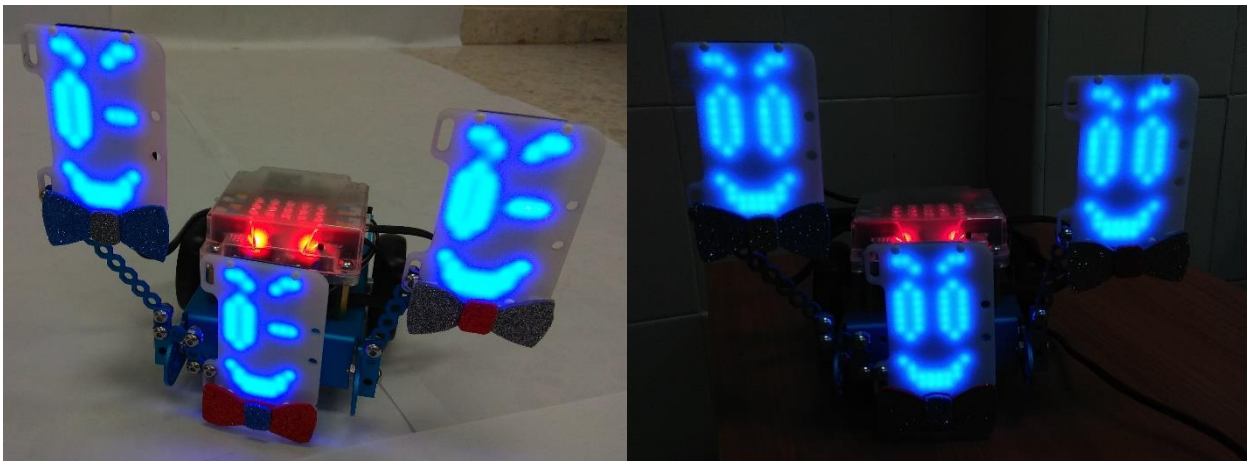
Once the music is finished, the mBot stops dancing and say goodbye with a wink.

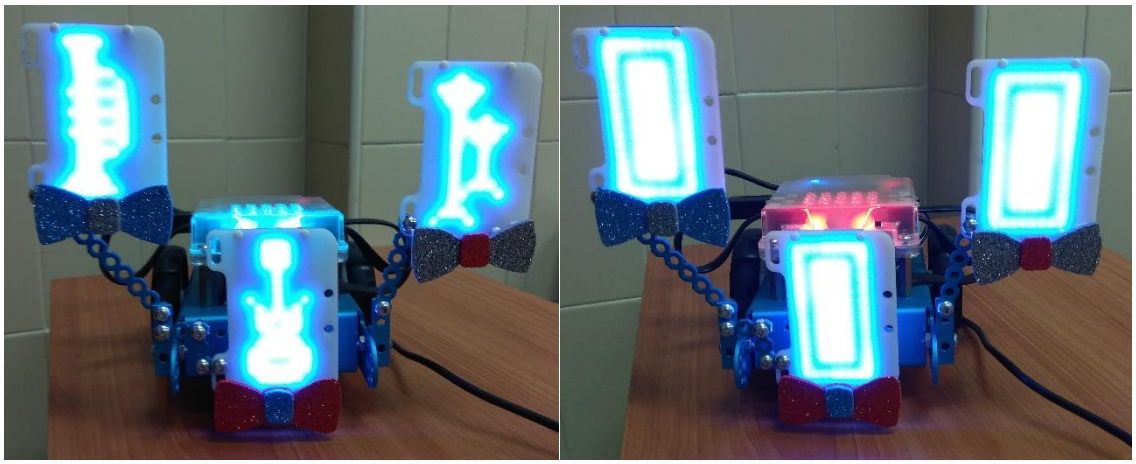


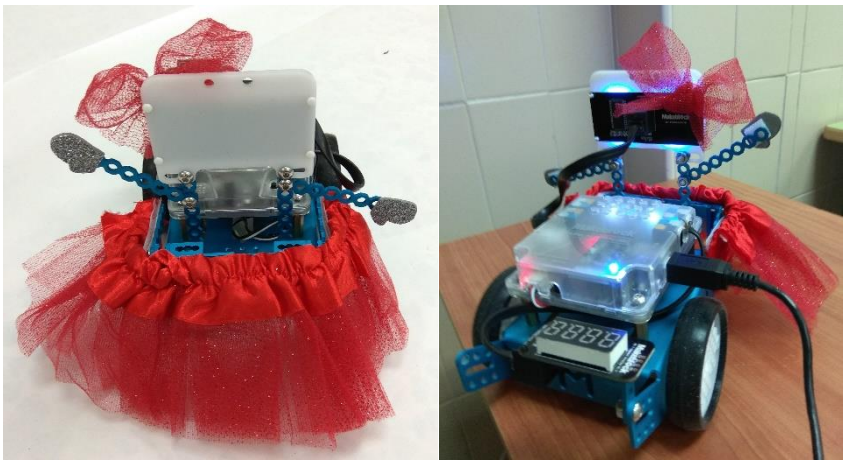
Once, the programming is finished, we start building up THE STRUCTURE, where all the mechanical elements will be set. Also the electronic elements.

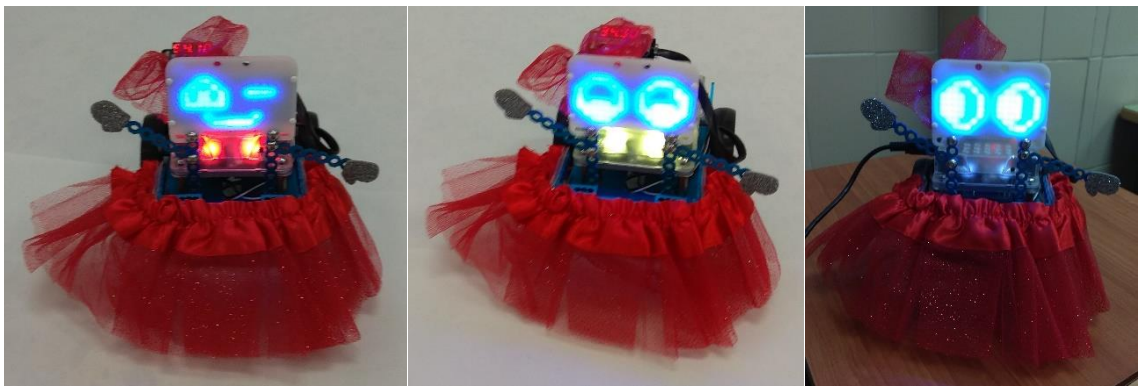


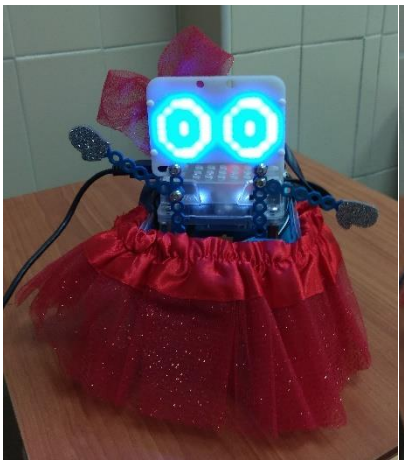
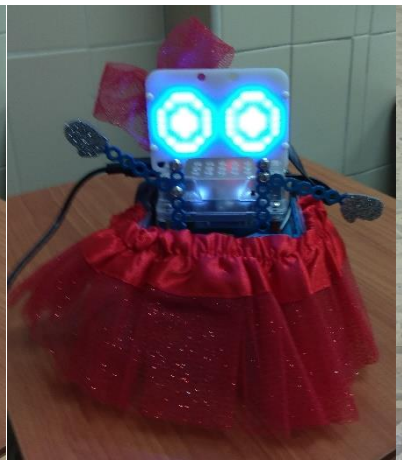











Second version

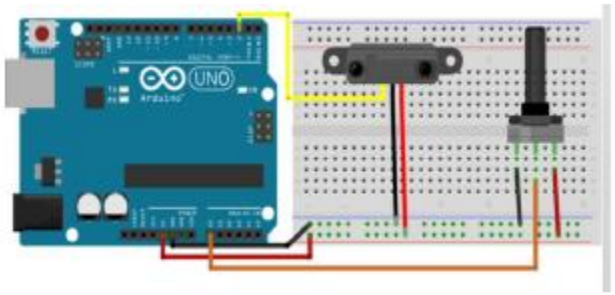
Step 1**:** Circuit diagram created by Fritzing. (You can also use ThinkCorD to ask)

The potentiometer and ultrasonic sensor are supplied from the common cathode lead to the power generated.

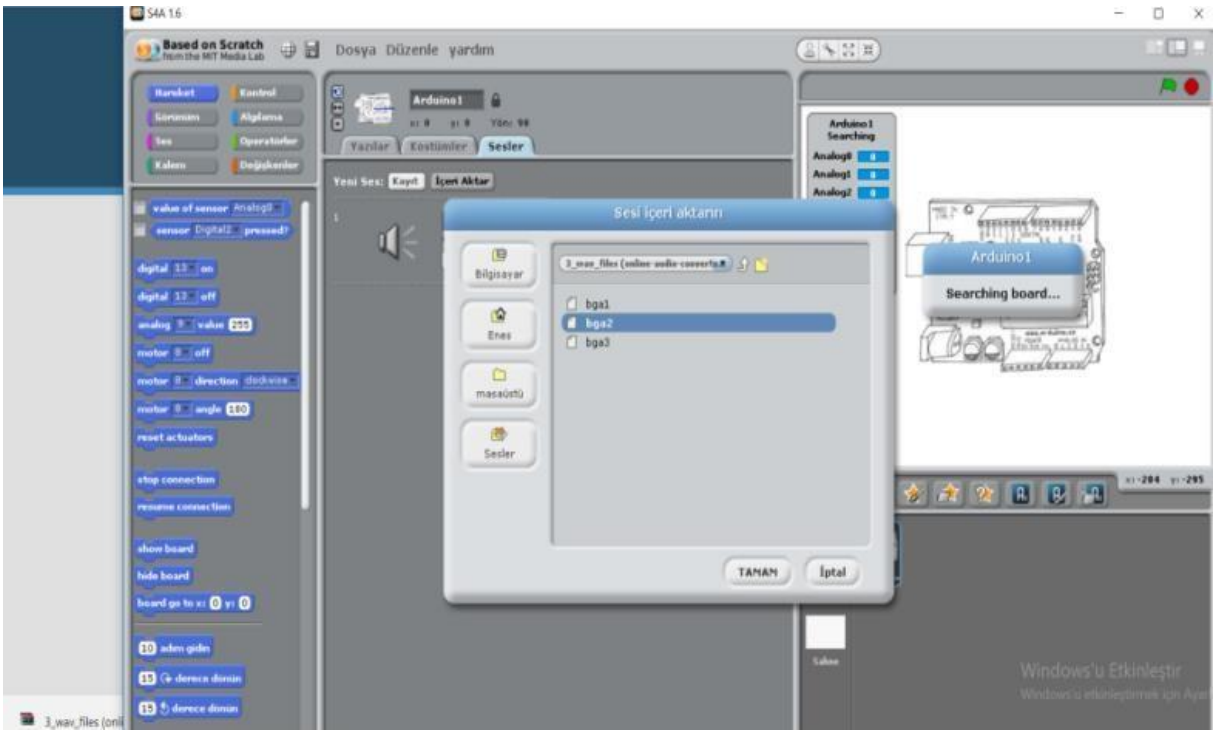
The potentiometer and the ultrasonic sensor are connected to the common anode via the gnd. To measure the potentiometer value, the analogue must be connected to any pine.

The ultrasonic sensor is connected to digital number 2 pine.

Cardboard can be powered by either a 9 volt or a pcbusb cable.

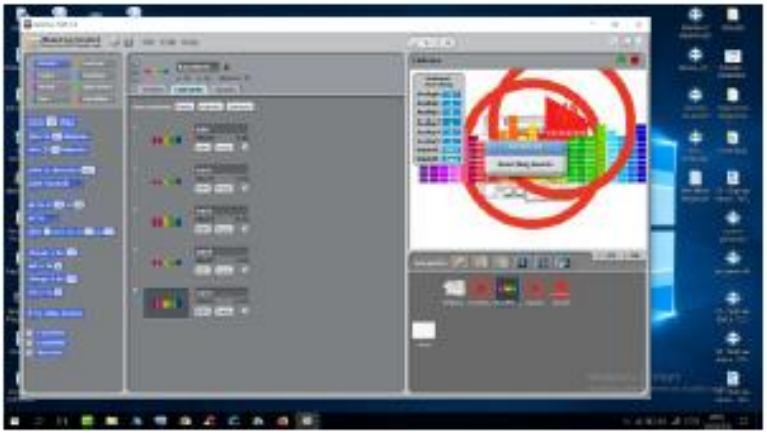


Step 2: We are loading music to program. The format of the music must be Mp3 or Wav. Sounds/Import/Files.

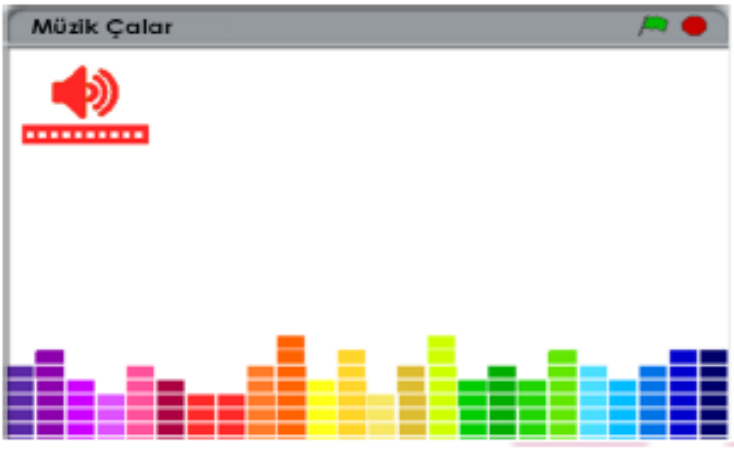


We upload images that we will use in the system. This can be done by verifying the picture or by loading the sprite.

It is added as the first character from the images to be loaded for the melody, and the others are added as costumes.

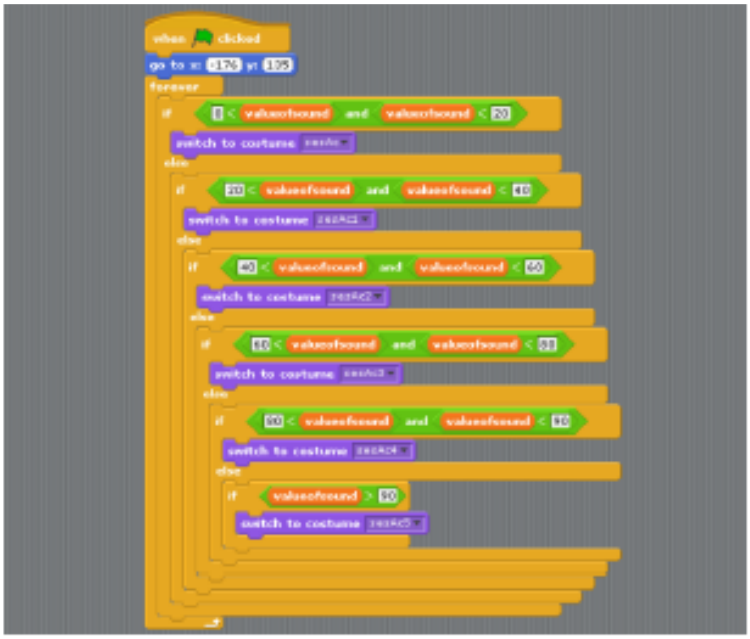


The final screen layout should look like this. Images added as characters will appear directly on the screen. It can be hidden with code to not show them in the first stage.

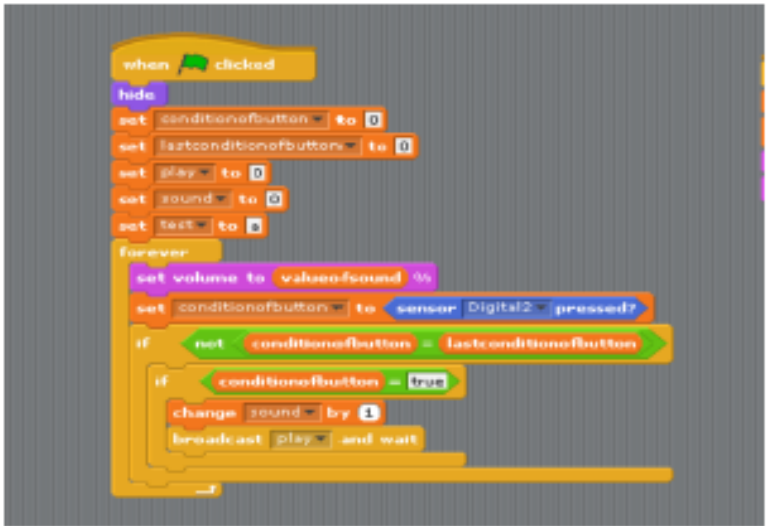


Step 3: We create the variables to be used for coding.

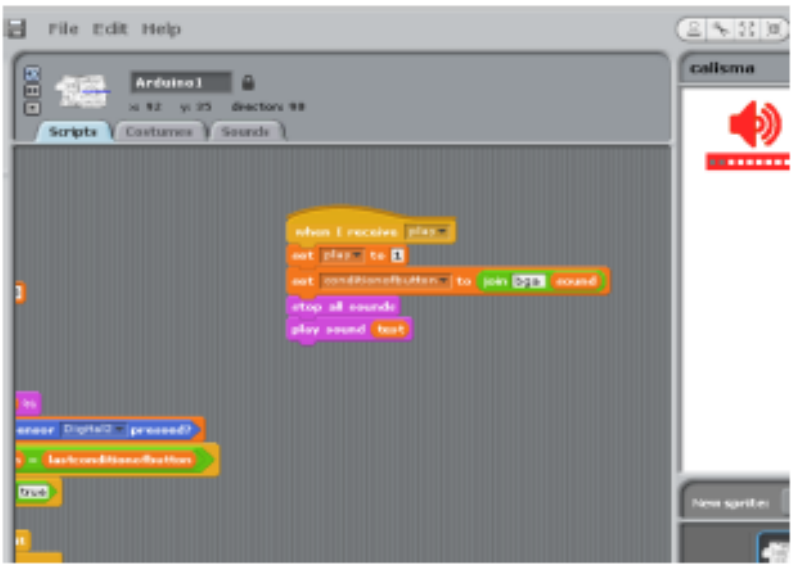
Our volume-editing code blocks are visible. The program codes will be loaded into Drive along with the mBlock codes.



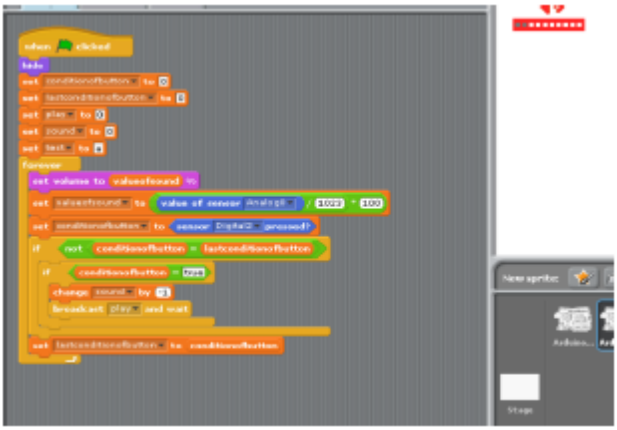
Our other code blocks:

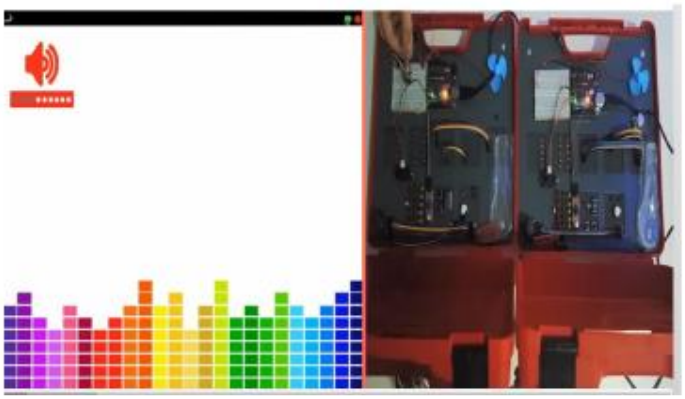


Required code blocks for the second Arduino card

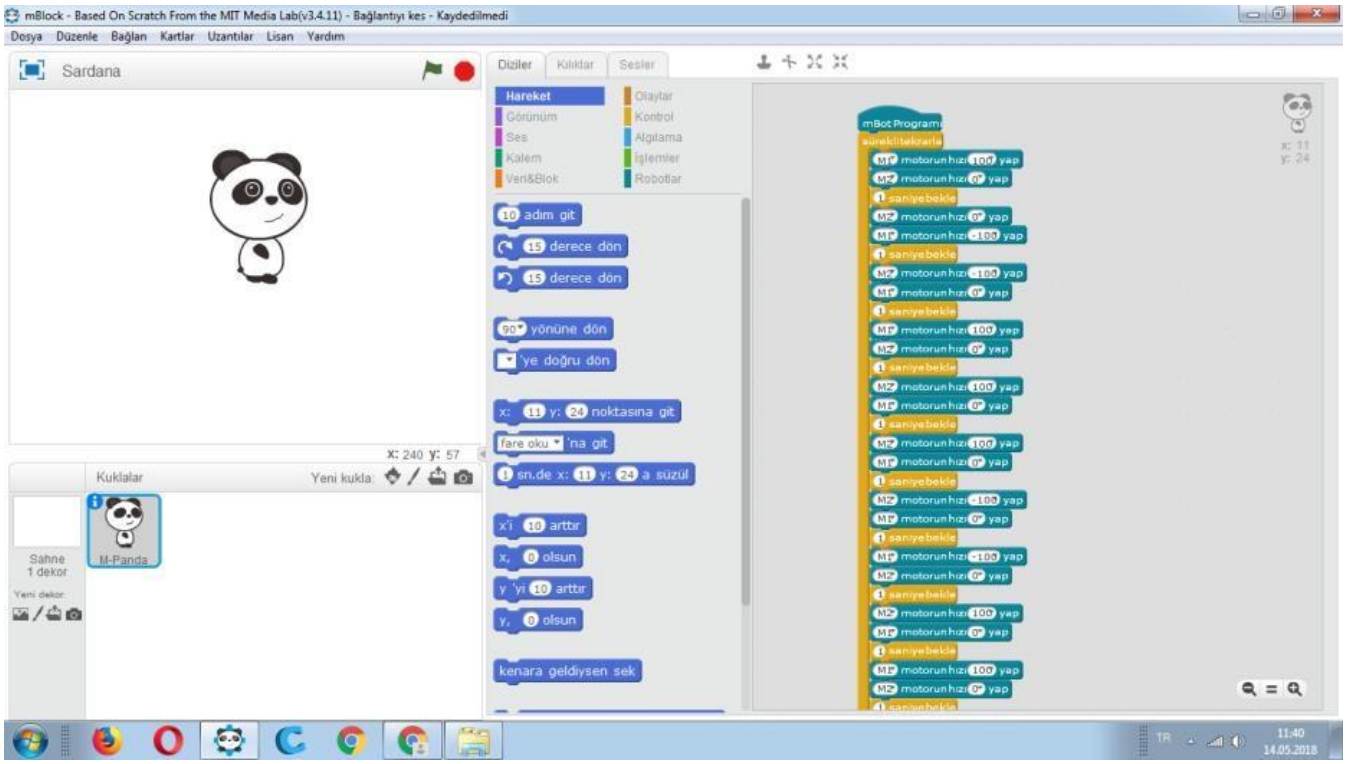


The final image of our system. Our music players are now ready.



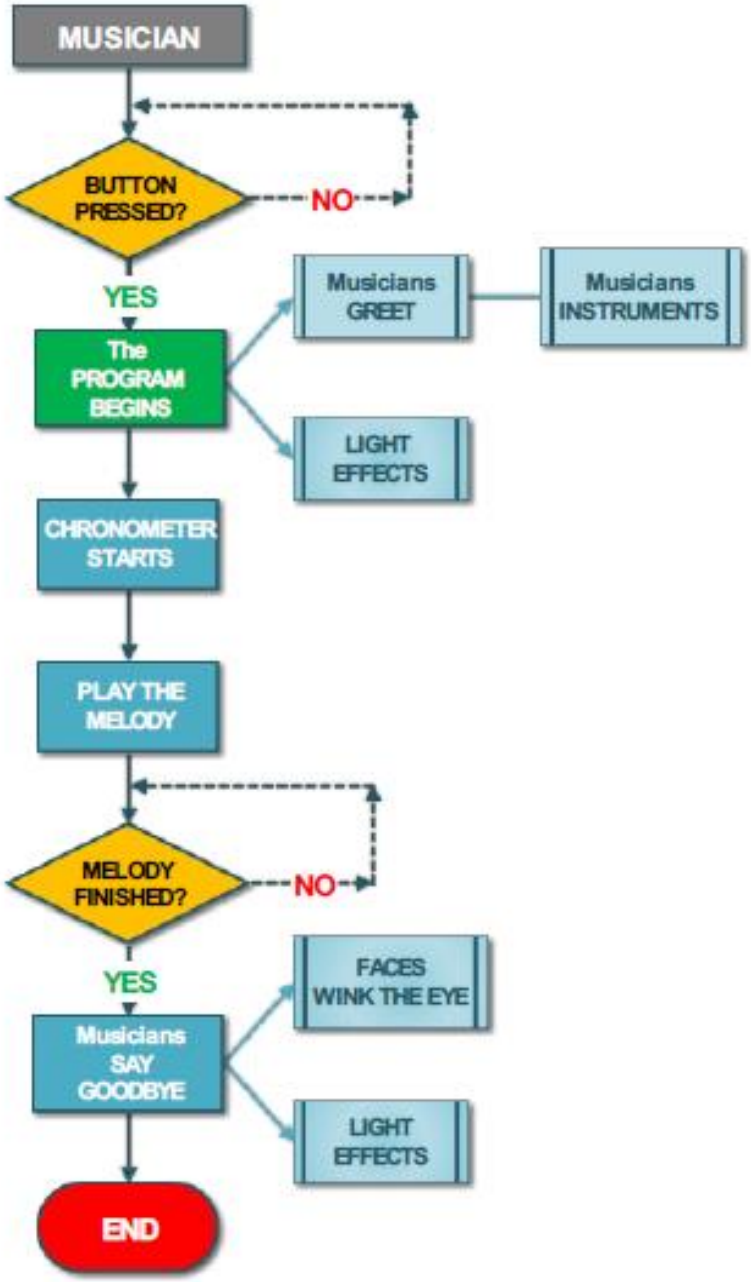


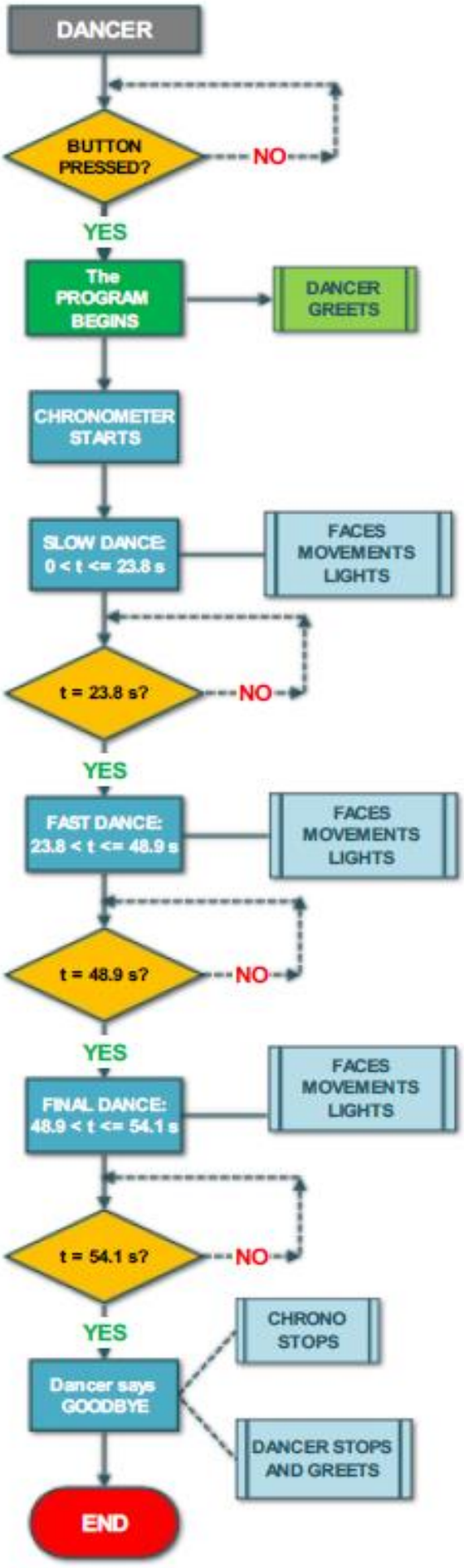
Last Step: mBlock codes for mBot



FLOW CHART

First version




DANCER
BUTTON PRESSED?
NO
YES
The PROGRAM BEGINS
DANCER GREETS
CHRONOMETER STARTS
SLOW DANCE: 0 < t <= 23.8 s
FACES MOVEMENTS LIGHTS
t = 23.8 s?
NO
YES
FAST DANCE: 23.8 < t <= 48.9 s
FACES MOVEMENTS LIGHTS
t = 48.9 s?
NO
YES
FINAL DANCE: 48.9 < t <= 54.1 s
FACES MOVEMENTS LIGHTS
t = 54.1 s?
NO
YES
CHRONO STOPS
Dancer says GOODBYE
DANCER STOPS AND GREETS
END

STUDENT'S EVALUATION

For the evaluation of the students in this activity, use the Evaluation Rubric designed for this project.

BIBLIOGRAPHY

"Guía de Scratch". CEIP de Cella, (Teruel). Pdf.

"Scratch. Guía didáctica para profesores". (Pdf). (www.isuriarte.com).

"Jugando con MBlock". Makeblock España.

"Divirtiéndome con MBot". Susana Oubiña.

Comunidad de Makeblock en español. (http://www.makeblock.es/foro/).

"Curso de Scratch + Arduino". J. Javier Esquiva Mira.

MORE INFORMATION

DIFFICULTIES:

- RESET THE CHRONO: within a loop, when the chrono starts, if we enter waiting times, the activity is disorganized.