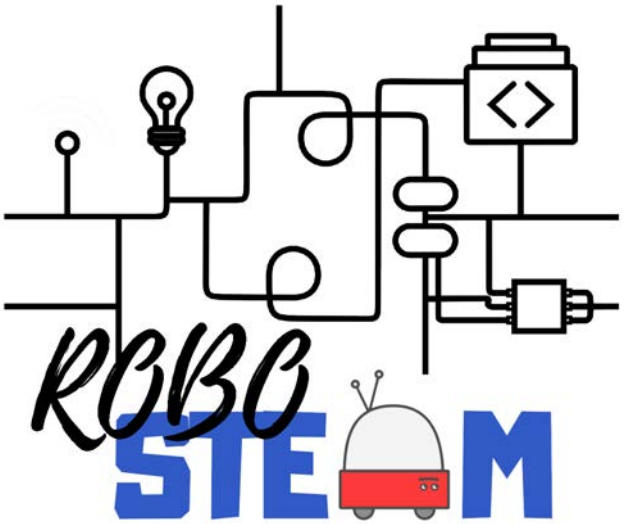
E1. RoboSTEAM Hackathon



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Project Number: 2018-1-ES01-KA201-050939

Version History

Version	Date	Comments
0.1	30/11/2020	First Draft after finishing the event
0.2	31/12/2020	Compiled signatures and contents
1.0	29/05/2021	Format and data corrections

Table of Contents

1. E1.Hackathon

This document describes RoboSTEAM hackathon Multiplier Event carried out in the Polytechnic Institute of Bragança in the context of RoboSTEAM project [1-8], at the three of November of 2020. The document includes the event description.

2. Event Description

2.1. Description and aim of the activity

The Robostem Hackaton was a competitive event in which the participants, developed nanochalenges based on physical devices and simulation, that were used in challenge-based learning activities [9, 10] during the RoboSTEAM Project. The Hackaton was intended for students and researchers, and it is a multiplier event that had as goal to share some of the Intellectual Outputs of RoboSTEAM Project, with a wider audience. In addition, the Hackathon serves as a testing work bench for the Hardware in the Loop Prototype defined as O3.COVID-19_1 [11] in the scope of COVID-19 [12-24] extension.

2.2. Agenda of the activity

3 of November:

14:00 to 15:00 Reception of the Participants

15:00 to 17:00 Lecture related with Mbot programming with Scratch

17:00 to 19:00 Lecture related with Robot programming based on a hardware in the loop approach

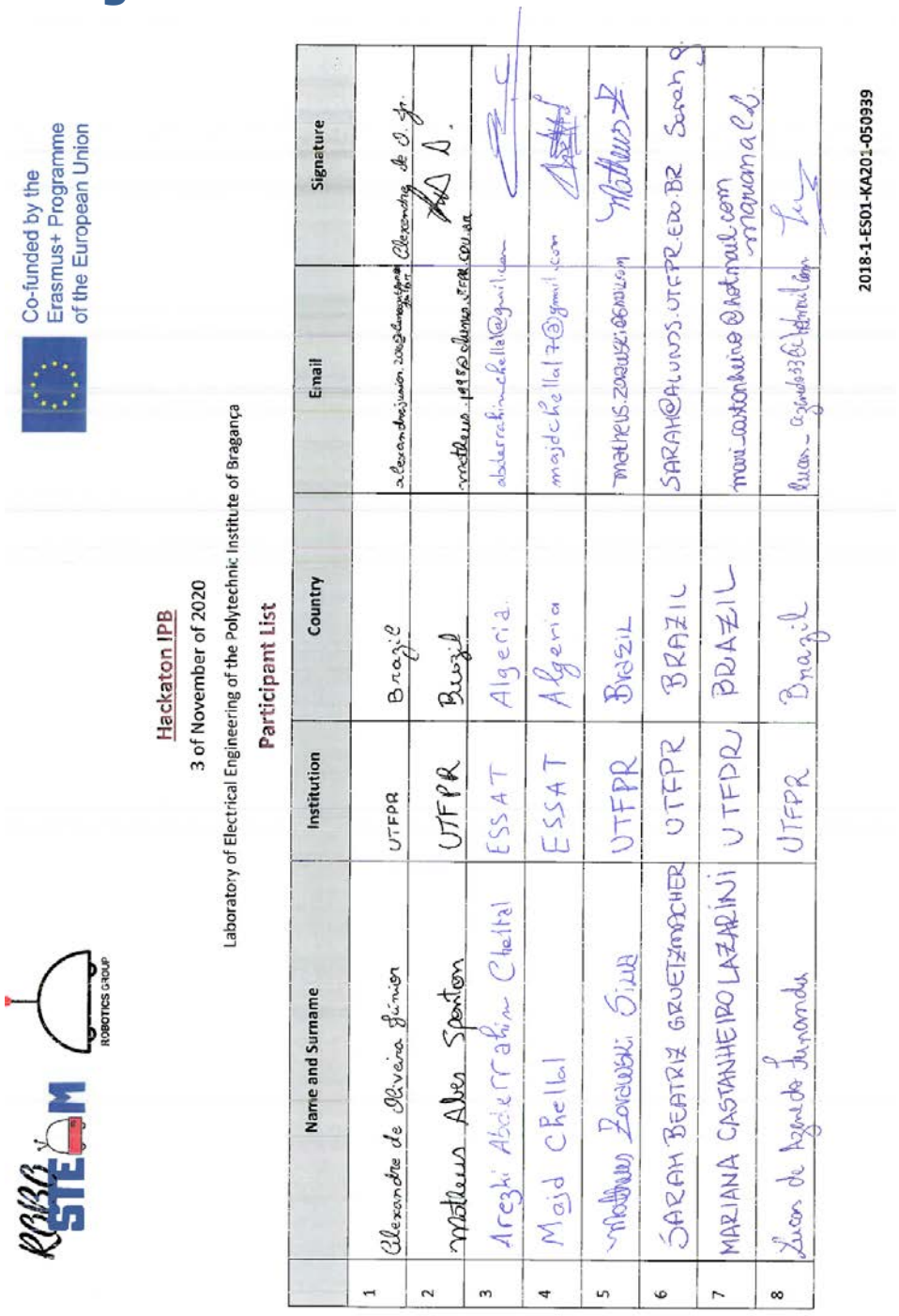
Dinner Break: 19:00 to 21:00

21:00 to 23:00 challenge solving based on the proposed hardware and simulation based proposed tools.

2.3. Tools used during the activity

One the used platforms was the mBot, in which it uses the mBlock 5 software to program it, from the MakeBlock Co. Ltd. Company and also a simulated robot, prototyped to compete in the micromouse competition, using a hardware in the loop approach. To minimize the gap between the simulation and the real implementation, an Hardware-in-the-loop technique was proposed allowing to control a simulated Arduino based robot with real hardware.

3. Signatures



Co-funded by the
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of the European Union

Hackaton IPB

3 of November of 2020

Laboratory of Electrical Engineering of the Polytechnic Institute of Bragança

Participant List

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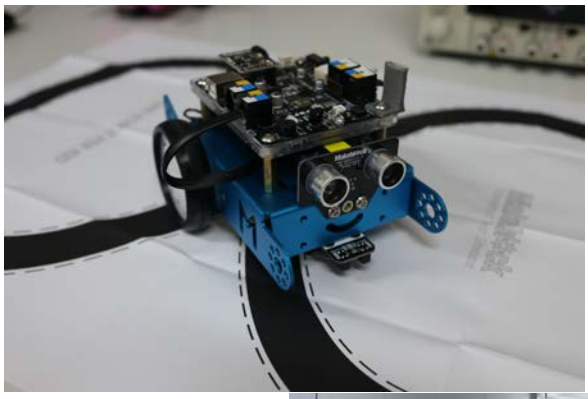
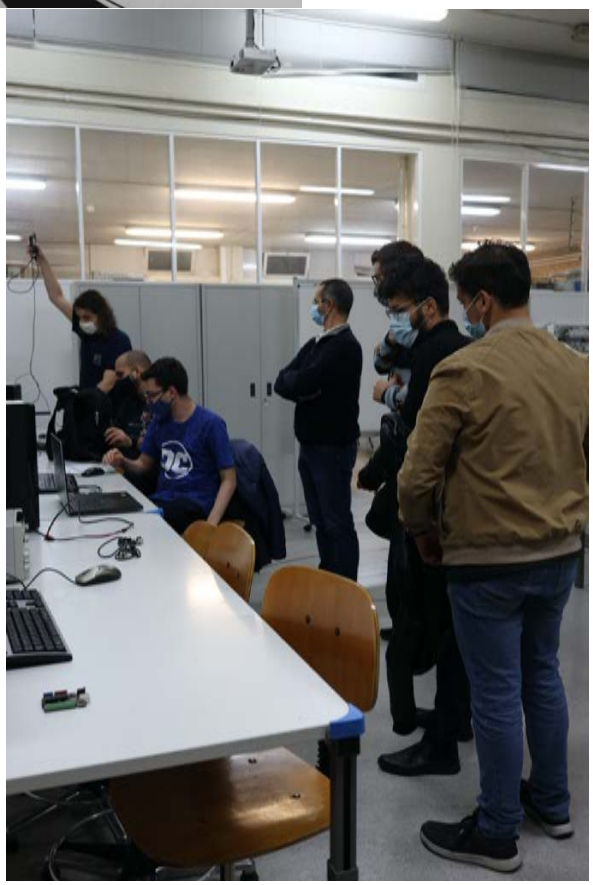
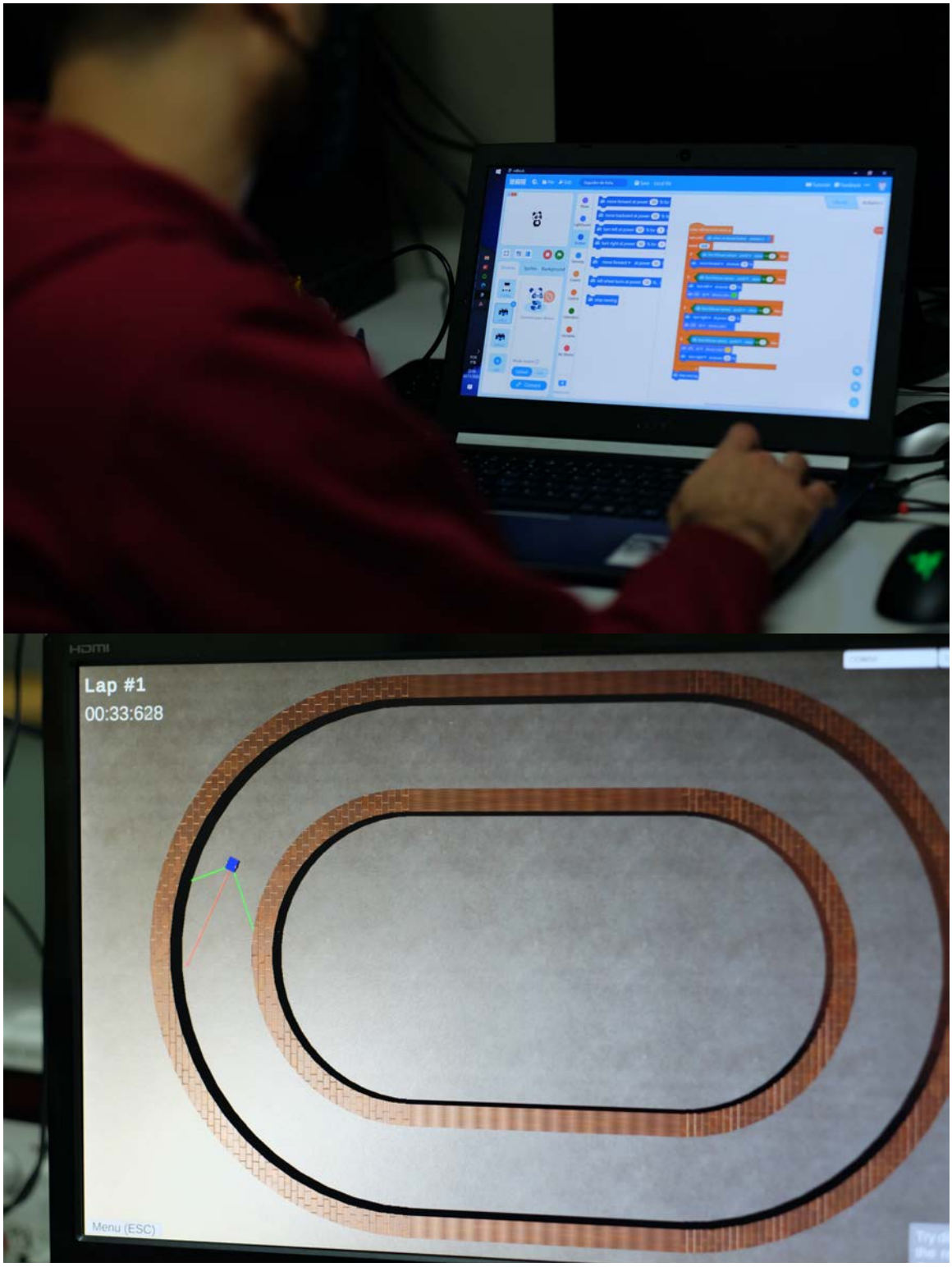
2018-1-ES01-KA201-050939

4. Photos

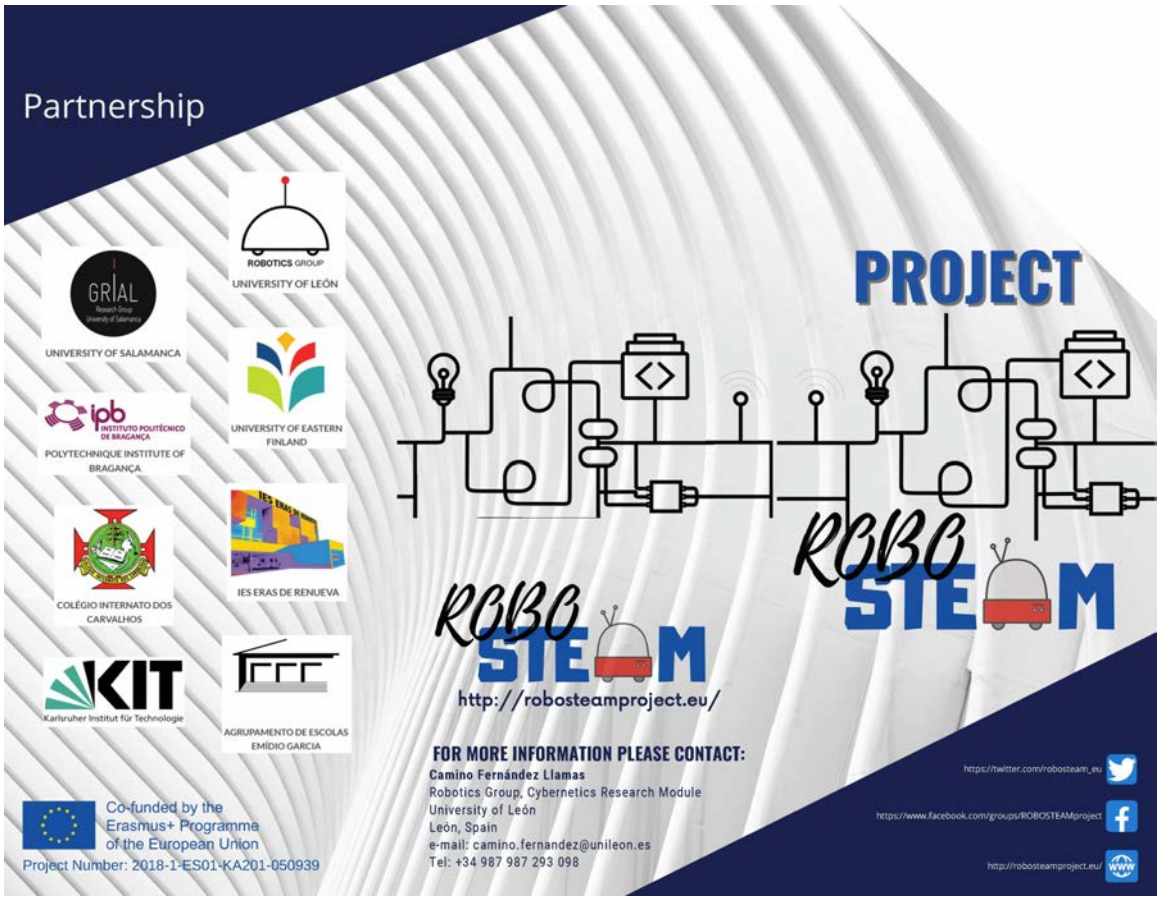


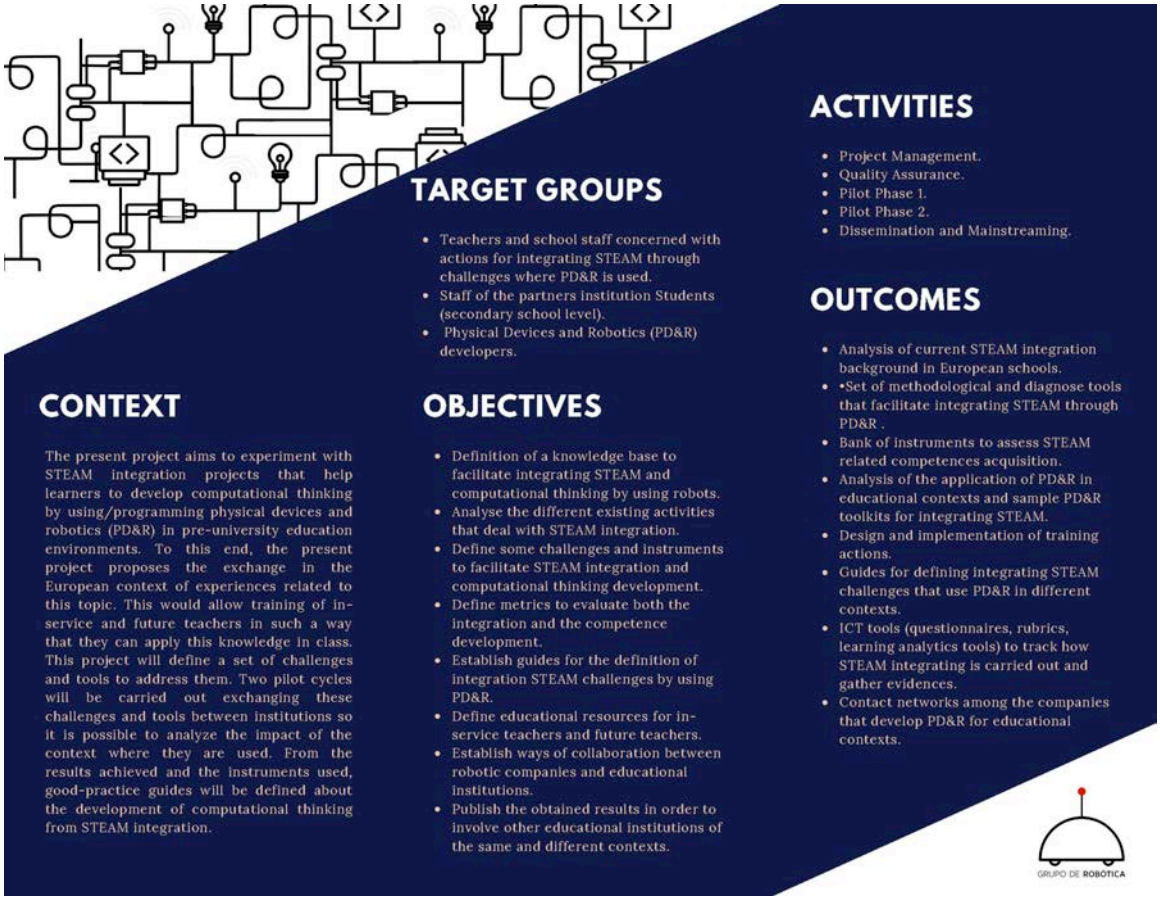



HDMI
Lap #1
00:33:628
Menu (ESC)

5. Documentation

5.1. Leaflet




TARGET GROUPS
• Teachers and school staff concerned with actions for integrating STEAM through challenges where PD&R is used.
• Staff of the partners institution Students (secondary school level).
• Physical Devices and Robotics (PD&R) developers.
ACTIVITIES
• Project Management.
• Quality Assurance.
• Pilot Phase 1.
• Pilot Phase 2.
• Dissemination and Mainstreaming.
OUTCOMES
• Analysis of current STEAM integration background in European schools.
• •Set of methodological and diagnose tools that facilitate integrating STEAM through PD&R .
• Bank of instruments to assess STEAM related competences acquisition.
• Analysis of the application of PD&R in educational contexts and sample PD&R toolkits for integrating STEAM.
• Design and implementation of training actions.
• Guides for defining integrating STEAM challenges that use PD&R in different contexts.
• ICT tools (questionnaires, rubrics, learning analytics tools) to track how STEAM integrating is carried out and gather evidences.
• Contact networks among the companies that develop PD&R for educational contexts.
CONTEXT
The present project aims to experiment with STEAM integration projects that help learners to develop computational thinking by using/programming physical devices and robotics (PD&R) in pre-university education environments. To this end, the present project proposes the exchange in the European context of experiences related to this topic. This would allow training of in-service and future teachers in such a way that they can apply this knowledge in class. This project will define a set of challenges and tools to address them. Two pilot cycles will be carried out exchanging these challenges and tools between institutions so it is possible to analyze the impact of the context where they are used. From the results achieved and the instruments used, good-practice guides will be defined about the development of computational thinking from STEAM integration.
OBJECTIVES
• Definition of a knowledge base to facilitate integrating STEAM and computational thinking by using robots.
• Analyse the different existing activities that deal with STEAM integration.
• Define some challenges and instruments to facilitate STEAM integration and computational thinking development.
• Define metrics to evaluate both the integration and the competence development.
• Establish guides for the definition of integration STEAM challenges by using PD&R.
• Define educational resources for in-service teachers and future teachers.
• Establish ways of collaboration between robotic companies and educational institutions.
• Publish the obtained results in order to involve other educational institutions of the same and different contexts.
GRUPO DE ROBÓTICA

5.2. Presentation Sample

Programming Educational Robots with Scratch

Caio Camargo & José Gonçalves

January 2021

Instituto Politécnico de Bragança

1

Table of Contents

Introduction

What is Scratch?

Scratch is graphical block-based programming language developed by the MIT and was design to support STEAM training. With Scratch, beginners at programming can write their on program to build interactive stories, games and animations and help young people learn to think creatively, reason systematically, and work collaboratively - an essential skills for life in the 21st century [1, 2].

Scratch Environment

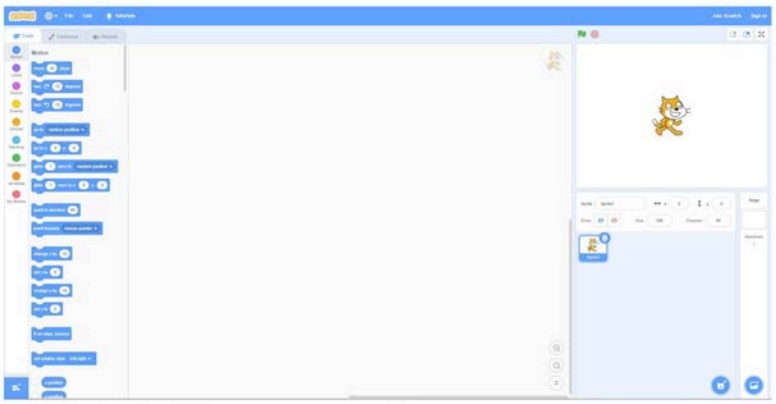


Figure 1: Scratch Environment. [3]

4

"Hello, World!" in Scratch

Dragging a few blocks to make Scratch say "hello, world". The Scratch has powerful features like:

- Variables (the ability to store values and change them)
- Threads (the ability for our program to do multiple things at once)
- Events (the ability to respond to changes in our program or inputs)

5

"Hello, World!" in Scratch

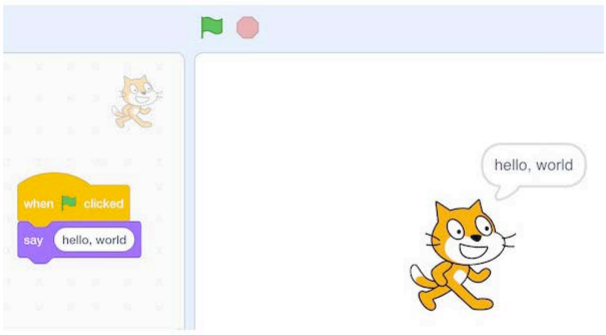


Figure 2: "Hello World" in Scratch. [4]

6

Exploring the Scratch

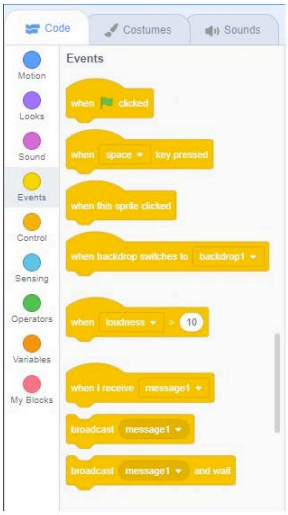


Figure 3: Scratch Menu.[3]

As we can see in the figure 3, there are several sub-menus in the Scratch environment, in each sub-menu the block are grouped by categories.

Each block has a specific function to do something into the program. The main block category is in the "Events" blocks, every program has to have one of these, whatever is the "when green flag clicked" or "when a key is pressed" block to start a program.

By exploring and testing each block, now it is possible to create your own program.

7

Scratch Program Example

Check out the Drone Fight Example in the url:
`https://scratch.mit.edu/projects/434291115`.

8

Programming Educational Robots

Educational Robot

Some robots available on the market in which can be programmed with Scratch. One of these is the mBot Robot produced by Makeblock Co. Ltd. shown in the figure 4.

Figure 4: mBot Robot. [5]

9

mBot Robot

The mBot already comes with 3 preset control modes: 1 - Obstacle avoidance mode, 2 - Line - follow mode and 3 - Manual control mode. About the specifications of mBot, the main control board is microcontroller ATmega328 and comes with a light sensor, button, IR receiver, ultrasonic sensor, line follower sensor, there are the possibilities to program other modules likes the buzzer, two RGB LED, IR transmitter and the motors. Can be powered with a 3.7V lithium battery or 6V (4x 1.5V) batteries[6].

10

mBlock IDE

The mBlock IDE(Integrated Development Environment) it is a Scratch 3.0-based software in which allows users to freely program various Arduino-based devices and devices from Makeblock Co. Ltd., it is also through this software that it is possible to program the mBot robot.

Figure 5: mBlock Logo. [7]

11

mBlock Environment

This is the mBlock Environment. It is quite similar with the Scratch, but the blocks here it has the purpose of interact with mBot's parts.

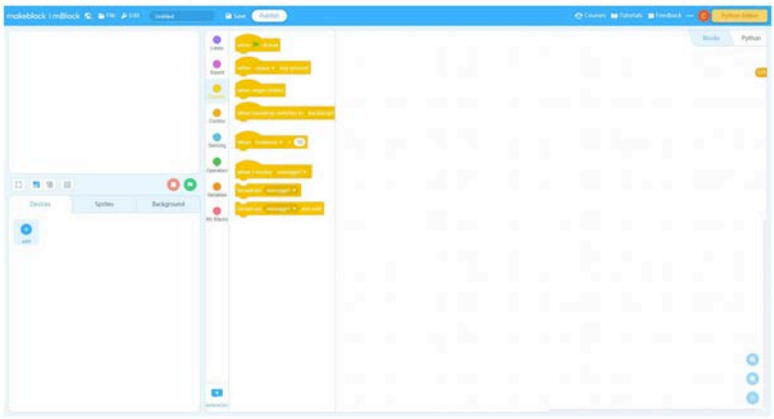


Figure 6: mBlock IDE. [7]

12

mBlock Environment

As we can see in the figure 6, on the left side, we have three tabs "Devices", "Sprites" and "Background". In mBlock we can also program as same as is in Scratch using the "Sprites" and "Background" tabs. But now we are going to look only in "Devices" tab, there it is possible to see the device library in which are possible to program using the mBlock, some devices are developed by the MakeBlock Co. Ltd. other is developed by third parties.

13

mBlock Environment

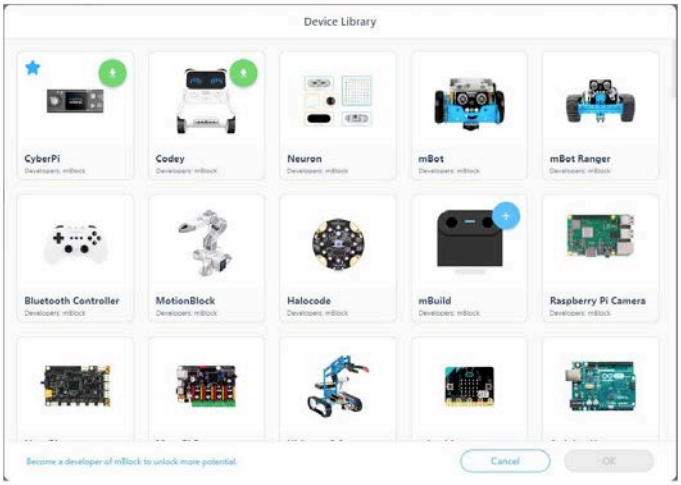


Figure 7: mBlock Devices Library.

14

The functioning of mBot sensors

As mentioned before, the mBot comes with embedded sensors and DC motors. One sensor is the Line Follower Sensor and the other is the Ultrasonic Sensor, as is shown in the figure 8.

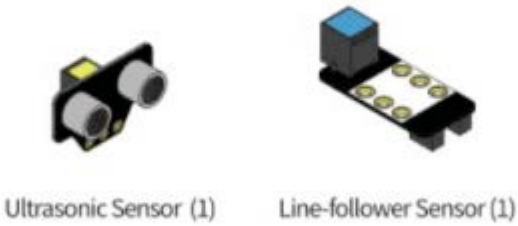


Figure 8: mBot Sensors. [6]

15

Line Follower Sensor

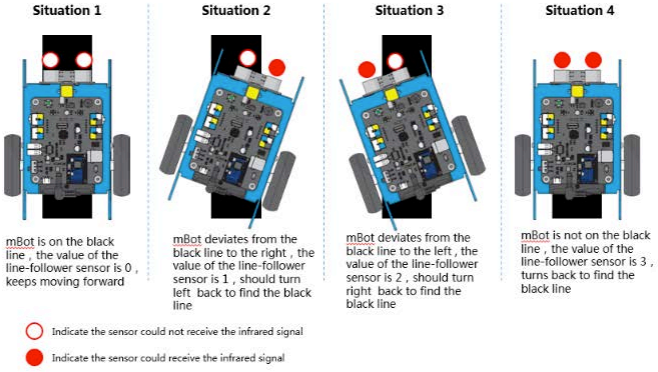


Figure 9: The functioning of the line followe sensor. [8]

16

Ultrasonic Sensor

Figure 10: Obtain Ultrasonic Sensor Data

Figure 11: Ultrasonic Sensor. [9]

To obtain the data returned from the Ultrasonic Sensor shown in the figure 11, we have to make this sequence of blocks shown in the figure 10. A full explanation of how the sensor works is give in [10, 11].

17

Examples

With this, it is possible now, to make the mBot a few examples as:

1. Follow a line;
2. Obstacle avoidance;
3. And Item 1. and 2. together.

18

1. Follow a line

Figure 12: Example to make the mBot follow a line.

19

2. Obstacle avoidance

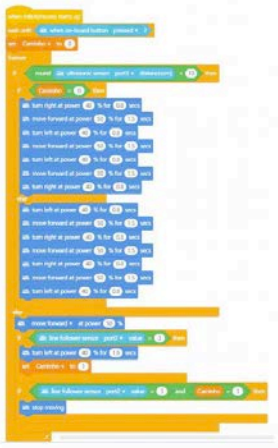


Figure 13: Example to make the mBot avoid an obstacle.

20

2018-1-ES01-KA201-050939

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22

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23

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24

Acknowledgements

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