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Sommario

"ROBO (Remain On BOard). Learning Journeys in Educational Robotics" – N. 2017-1-IT02-KA219-036552_1
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A FEW WORDS ON THIS ACTIVITY PLAN

You can use this plan either as they are or as a starting point to develop your own customised plans. Some of you may need to make small changes to suit the abilities of your students.

The lessons begin with the easier basic movement behaviours and end with the line tracking.

Our goal is to make our students really enjoy the programming process, problem solving and collaboration.

A number of worksheets will be provided for each lesson. The Worksheets sill allow students to work independently as they include instructions for student to follow. The Worksheets also include questions for the students to answer that reinforce and demonstrate their learning.

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ACTIVITY PLAN

SIMPLE LINE TRACKING ROBOT
AUTHOR: Filippa Alcamesi, Giancarlo Lentini

SHORT DESCRIPTION OF THE ACTIVITY

Students will build a robot car following a track without intersections.

CONTENT

Choose categories and give a rating of the level of emphasis on concepts from each of the following domains:

Science (0-10)	Technology (0-10)	Mathematics (0-10)	Mechanics (0-10)	Language (0-10)	Society (0-10)	Life Skills (0-10)
2	10	10	8	10	5	5

OBJECTIVES

Subject related	Study the angle and position of all materials (servo motors, circuits, sensors) in order for the line follower robot to be autonomous and move correctly
Technology use related	Programming with Arduino
Social and action related	Develop collaborative skills, take roles within groups, communicate with other groups to exchange ideas and tips, advice
Argumentation related	Practice making conjectures about how the robot will react to external stimuli based on the program given or formulate and define an authentic problem,

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	make assumptions, test possible solutions, choose the best solution, communicate with other "makers".

TIME

Duration: 4 weeks

Schedule: 2 hours per week

MATERIALS AND ARTIFACTS

Digital artifact	Programming language (Arduino programming environment)
Robotic artifact	A car
Student's workbook and manual	On line tutorial with step-by-step instructions for the electronic part and programming part too, activity sheets, Arduino manual, evaluation sheet

STUDENTS

Sex and Age:	Boys & girls, 16-18 years old
Prior knowledge:	Little if any knowledge of Arduino; some of them experts on electronics; basic knowledge of programming concepts (like if-then concepts)
Nationality and cultural background	• 20 pupils from Italy (home session) • 5 pupils from Italy, 5 from Bulgaria, 5 from Poland, 5 from Romania (mobility sessions)
Social status and social environment	Public school

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Special needs and abilities	Arduino programming environment is in English. English is not native language for participants

SPACE INFO

Organizational and cultural context: in school at the electrotechnics and automation laboratory; during project time in school; after school activity in peer-to-peer tutoring with Electrotechnics students.

Physical characteristics: indoors

GROUPING

Grouping criteria	Mixed ability; mixed gender; mixed specialties (Electrotechnics, Biotechnologies)
Setting	Students in small groups with one Arduino kit and one computer available for each group

INTERACTION DURING THE ACTIVITY

Actions	Exchange ideas, dialogue, negotiation, debate
Relationships	Collaborative
Roles in the group	Pre-defined roles
Support by the teacher(s)	Intervene, monitor, facilitate

EXPECTED STUDENT ACTIVITY

Students during the activity are expected to engage in the following actions: construct, observe, communicate, create, exchange ideas, etc.

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IN THE CLASSROOM

LESSON 1: INTRODUCTION AND EXPERIMENTATION

Duration: 2 hours

Orchestration: group work

Description: Students are engaged in discussion about robotic behaviors and how the creator-programmer can give the desired functionalities and characteristics to a robotic device. Students are introduced to available parts, sensors, motors. They experiment with different values and settings and observe the results on the class floor.

Teaching method: demonstration by example, discussion, experimentation

LESSON 2: GET FAMILIAR AND SET UP

Duration: 2 hours

Orchestration: group work

Description: Technology skills - Students familiarise themselves with the programming environment and how to download a program to the robot.

1. Set up and become familiar with Arduino programs
2. Open software and become familiar with how to move robots
3. Download test program

Teaching method: demonstration by example, discussion, experimentation

LESSON 3: ROBOT MOVEMENT - DRIVING

Duration: 2 hours

Orchestration: group work

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Description: Introduction to sequential programming – Students learn how the robot responds to command and bring together the concepts of time, speed and distance.

Program 1 – Drive the robot forward
Program 2 – Drive the robot backward
Program 3 – Drive the robot forward and backward
Program 4 – Speed play

Teaching method: demonstration by example, discussion, experimentation

LESSON 4: ROBOT MOVEMENT - TURNING

Duration: 2 hours

Orchestration: group work

Description: Sequential programing and basic geometry – Students learn how the robot responds to time and geometry and how they can achieve driving control of the robot.

Program 1 – Right turn
Program 2 – Left turn
Program 3 – Right and then left turn

Teaching method: demonstration by example, discussion, experimentation

LESSON 5: ROBOT MOVEMENT - LINE TRACKING

Duration: 30 minutes

Orchestration: individual and class work

Description: Reinforce learning – Students use knowledge from lessons 1 through 3 to achieve a fun open ended activity for the first on line session in February: a line tracking robot.

Teaching method: demonstration by example, discussion, experimentation

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ASSESSMENT PROCEDURES

post activity tests, reflective videos

UNEXPECTED AND/OR INTERESTING INCIDENTS

Our robot follows the line correctly without mistakes after lowering the sensor to get nearer to the floor (at least 3 mm).

HOW DID YOU FACILITATE THE EMERGENCE OF CRITICAL INCIDENTS?

The students gave their own opinions on the possible solution. The Special Needs students also cooperated proposing a plausible reason for the bad behavior of the robot, which everyone accepted.

EVIDENCE OF STUDENT LEARNING

Students cooperated with success. They clarified the nature of an assignment, interpreted complex instructions, explained ideas, gave feedback and corrections, took responsibility for difficult parts of the assignment (Electrotechnics students for the connection of wires), scaffolded problem-solving efforts, and provided encouragement. The student with Special Needs gained self-esteem.

IDEAS FOR EXTENSIONS/REVISIONS OF THE INITIAL ACTIVITY PLAN

(Courtesy of the ER4STEM Project, with modifications - http://er4stem.com/)

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