Cutebot Line Tracking

Materials per team or group:

- Computer with internet access
- 1 Micro:bit with USB cable
- 1 cutebot with battery pack
- 1 Line-tracking Map

Alignment with CODERS module(s):

- Cutebot

MLS Standards:

4.AP.M.01 – Decompose (breakdown) large problems into smaller, manageable subproblems to facilitate the program development process.

5.AP.M.01 – Decompose (breakdown) large problems into smaller, manageable subproblems and then into a precise sequence of instructions.

4.AP.A.01-Compare and simplify multiple algorithms (sets of step-by-step instructions) for accomplishing the same task verbally and kinesthetically, with robot devices or a programming language.

5.AP.A.01-Compare and simplify multiple algorithms (sets of step-by-step instructions) for accomplishing the same task verbally and kinesthetically, with robot devices or a programming language, then determine which is the most efficient.

4.AP.C.01-Create a program using control structures (e.g., sequence, conditionals, interactive-looping) to solve a problem or express ideas both independently and collaboratively.

5.AP.C.01-Create a program using control structures (e.g., sequence, conditionals, interactive-looping), event handlers and variables to solve a problem or express ideas both independently and collaboratively.

4.AP.M.02 – With grade appropriate complexity, modify, remix or incorporate portions of an existing program into one's own work, to develop something new or add more advanced features.

5.AP.M.02 – With grade appropriate complexity, modify, remix or incorporate portions of an existing program into one's own work, to develop something new or add more advanced features.

4.AP.PD.01 – Use an iterative and collaborative process to plan the development of a program that includes user preferences while solving simple problems.

5.AP.PD.01 – Use an iterative and collaborative process to plan the development of a program that includes other perspectives and user preferences while solving simple problems.

4.AP.PD.03-Analyze, create and debug a program that includes sequencing, repetition, conditionals and variables in a programming language.

5.AP.PD.03-Analyze, examine, create and debug a program that includes sequencing, repetition, conditionals and variables in a programming language.

6-8.CS.HS.01 – Design projects that combine hardware and software to collect and exchange data.

6-8.DA.VT.01 – Collect data using computational tools and display it for the end user in an easy to understand way.

6-8.AP.V.01- Create clearly named variables to store and manipulate information.

6-8.AP.C.01- Design and develop combinations of control structures, nested loops and compound conditionals.

Objectives:

- Create a project to make cutebot follow the line tracking map.
- Implement the concept of motion.

Background information / Activation of Prior Knowledge:

- Access the MakeCode classroom.
- Basic computational thinking skills.
- Basic knowledge of block programming.

Introduction / Anticipatory Set:

- If this is the students first time using the Cutebots you may want to show this video Cutebot Intro.
- You may want to explore the features of the Cutebot. Perhaps having a demonstration for the students would be helpful along with an explanation of how the Cutebot works for younger students.
- For older students, you may want to just jump right into the lesson. This is an area where differentiation and accommodations are possible.
- Depending on your intention for the lesson, you can use Makecode Classroom to send the code to the students for them to start with, and then they can change it for their experiments. This can also save time, if necessary.

Teaching:

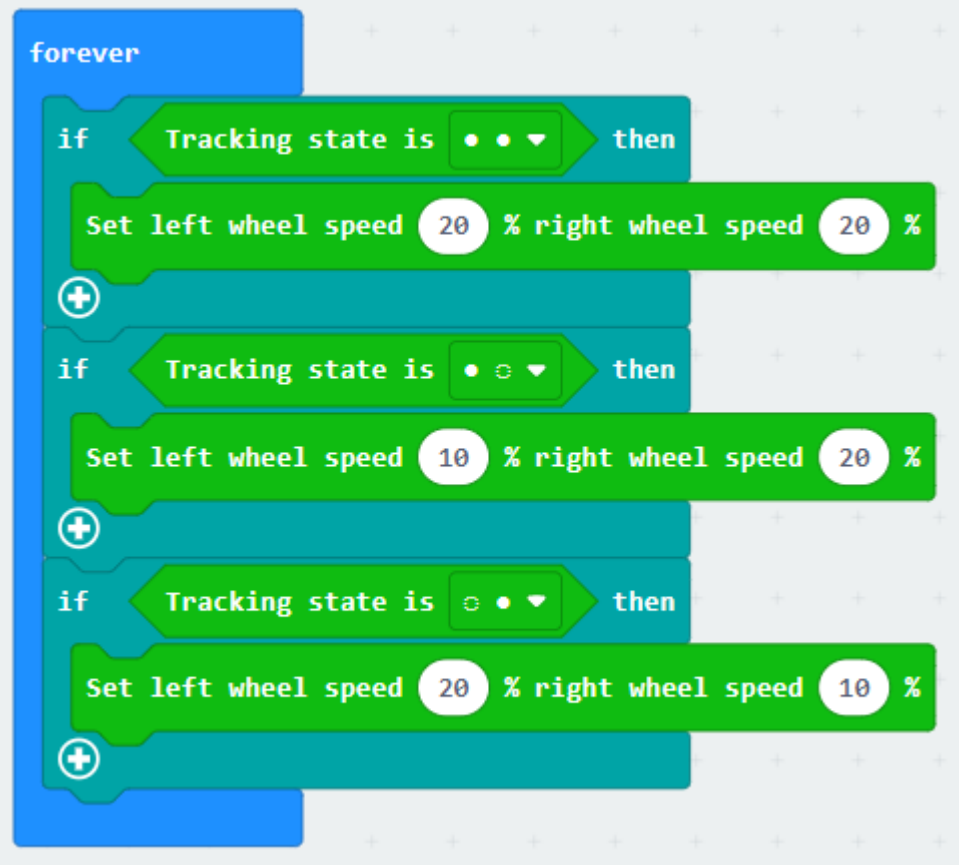
Introduce the goal of this project is to control the Cutebot as it follows the line-tracking map and understand the concept of motion with direction. Then depending on students skill level/demeanor there are options:

- For all students:
  - You can use this worksheet: Cutebot Line Tracking. You can modify it for your grade level in order for it to be appropriate.
  - Depending on your goal for the lesson, you may want to use Microbit Classroom and send the **"Code"** to the students, and then have the students run experiments.
- For older students:
  - Prompt paired students to write out instructions to program the functionality of the cutebot for a variety of speeds for the wheels. Then the students can compare the motion of the Cutebot among themselves.
  - After they have completed that assignment, you can quickly guide them through the **"Code"** section to ensure everyone is on the same page.

Code:

1. **Plan and design cutebot programs.**
   a. Insert the forever loop.
   b. Inside the loop, insert if condition.
   c. When tracking state is OO then set cutebot to follow blackline or move forward by set left wheel speed 20% right wheel speed 20%
   d. When tracking state is Oo then set cutebot to follow blackline by turning left by set left wheel speed 10% right wheel speed 20%

e. When tracking state is oO then set cutebot to follow blackline by turning right by set left wheel speed 20% right wheel speed 10%



2. **Design experiments to analyze the motion of cutebot.**
   Here you can prompt students to come up with their own experiments or provide them with the ones below:
   a. The first experiment would be to let the students come up with their own tracking-line map and analyze when cutebot moves forward and turns left or right.
   b. The next experiment would be to change the speed of the wheel into other values and analyze its motion.
   c. The next experiment would be to place the cutebot out of the tracking line and see how it moves. This is the experiment that is on the worksheet.
   d. The next experiment would be to place some obstacle in front of the cutebot and see how it moves.

3. **Perform the experiments designed in section #2.**
    a. Plug micro:bit into computer and connect to MakeCode.
    b. Download the code into micro:bit.
    c. Insert the micro:bit into the cutebot.
    d. Insert battery into cutebot.
    e. Place the cutebot onto the tracking line map and turn on the power button.
    f. Analyze the motion of the cutebot.

4. **Analyze the motion.**
    a. For example, when the cutebot turns left or right can be noted on a variety of speeds or wheels or how it behaves when placed out of the tracking line or if any obstacles occur.
    b. Discuss the movement of cutebot as a class; comparing and contrasting the observations collected from the experiments. For younger students, a class Venn diagram could be created and the students could use Post-its to write their answers.
    c. For older students**:**
        i. Write about the results collected from each experiment. Ask students to compare and contrast the results between experiments.
        ii. Were the results what they expected they would be? If not, then what might be happening to the results that changed them?