Cyber Security Initiative for Nevada Teachers (CSINT)

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Instruction in Cybersecurity Through the Use of Robotics and Python Coding
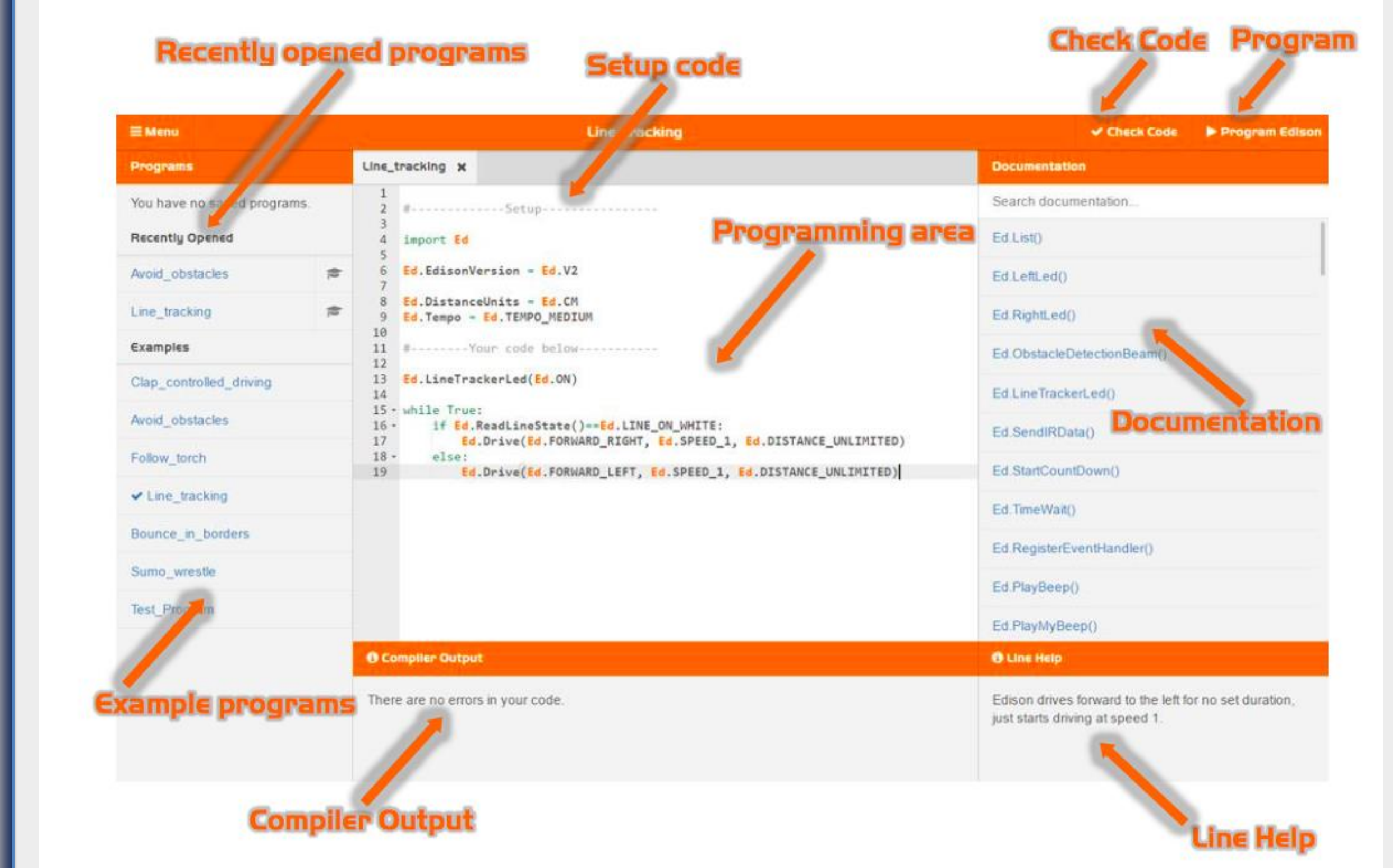
Introduction & Justification

The purpose of this lesson is to introduce students to computer science principles that are associated with cybersecurity through the use of robotic sensors. Robots are quickly becoming a part of our daily lives from simple household appliances to the idea of self-driving cars. These robots are intended to enhance our lives through the completion of simple task. In order to appreciate these little wonders there is a necessity to understand how the robots operate through a series of input and output sensors. Students will learn how to create algorithms in order to create an understandable code for the robots to perform specific tasks requested. This lesson will allow students to explore how sensors work on two wheeled robots called Edison. Students will then learn to understand how robotic sensors are similar to those sensors on the everyday robots. Students will use Python to code the Edison robot. The algorithms used to code the robot will utilize the different sensors available on the robot. The robot will be programmed to complete simple tasks involving the robotic sensors to build a better understanding how the sensors respond to the code, and to build upon the idea that cybersecurity is an integral piece to ensure that the code runs in the format that it was intended to be executed.
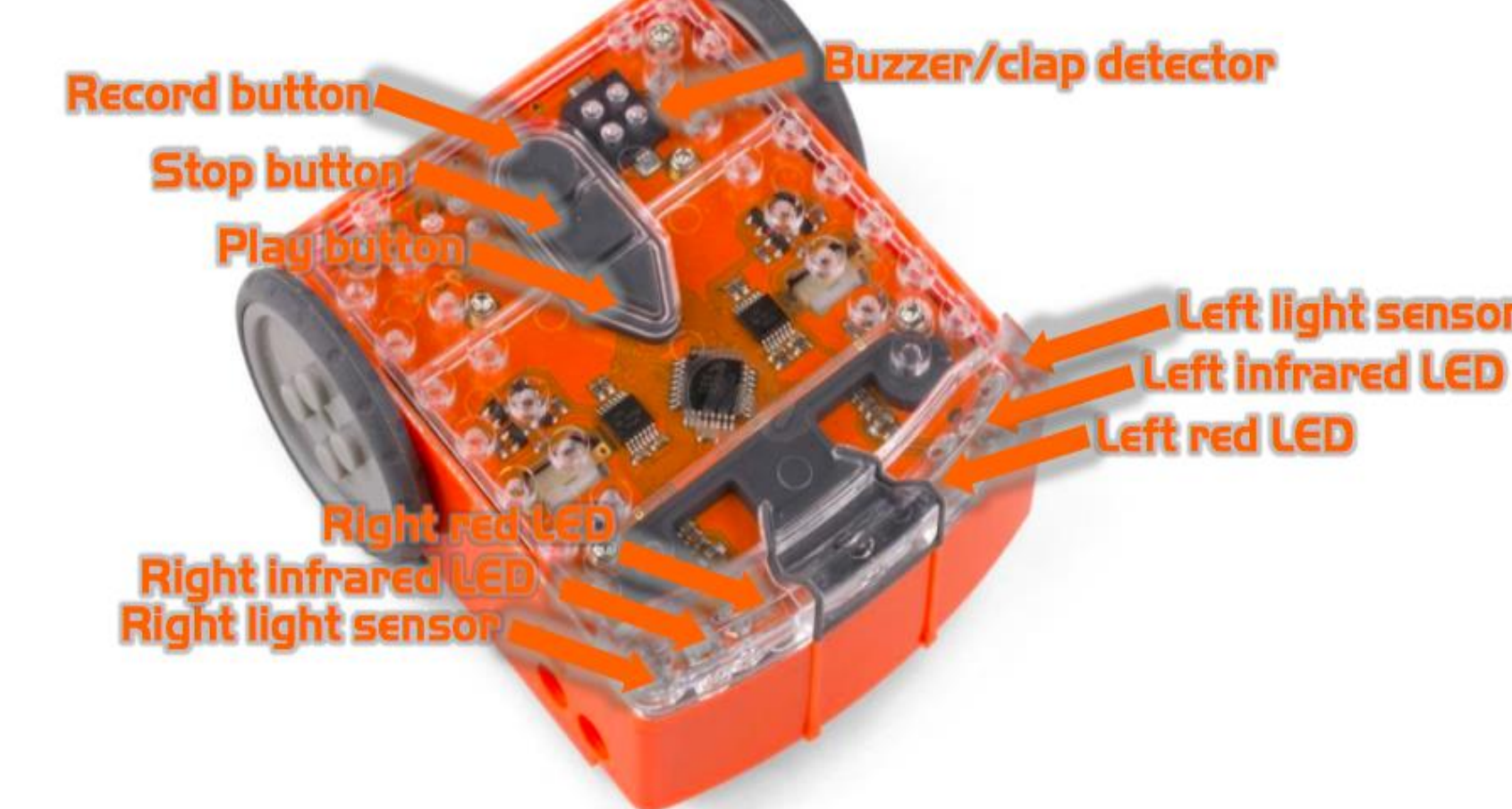
Objectives

Students will be able to:
- Understand that algorithms are used to carry out a series of instructions in order
- Extend the algorithms to carry out a series of instructions in order
- Explore and extend the concept of outputs through the use of sensors on the robot
- Explore the concept of a loop and use this concept to carry out a set of instructions

Standards

NGSS - Science & Engineering Practices:
MS-LS1-8. Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.
MS-LS4-5. Gather and synthesize information about technologies that have changed the way humans influence the inheritance of desired traits in organisms.
MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Edison

Programming Blocks

Engage

How will autonomous vehicles and modern day robots change in the future?
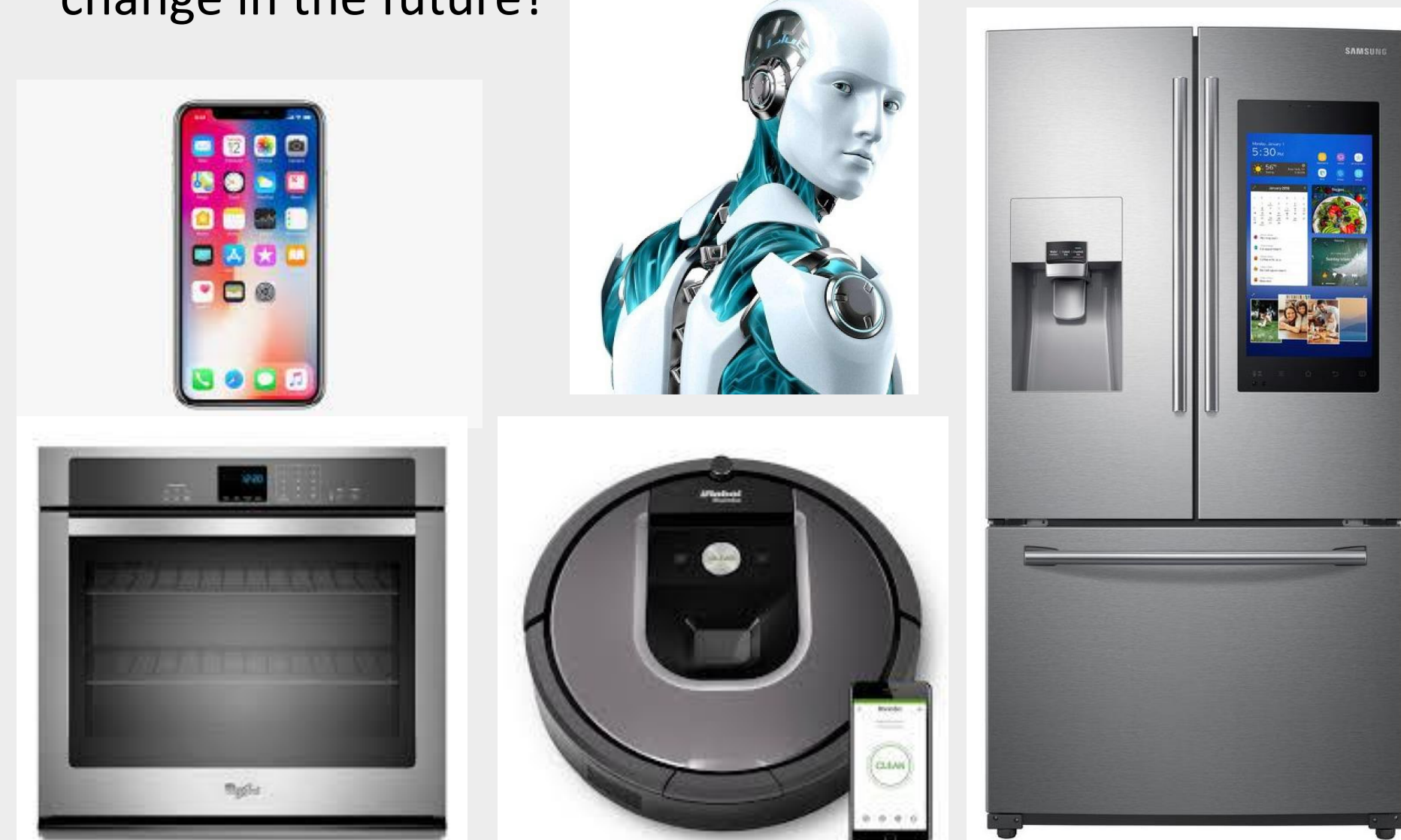
Explore

Students will progress through various aspects of Python coding and learning about sensors through increasing difficulty and complexity.
Step 1: Students will program Edison's sensors to navigate distances (moving forward and backward and learn to detect objects.
Step 2: Students build upon what they learned in step 1 to begin to detect and avoid obstacles.
Step 3: Students continue to build upon their knowledge and begin to include loops in their code to run their program.
Step 4: Students formulate a code to move Edison using only the sensors.
Step 5: Students use their code from all the previous steps to have Edison start at a beginning point and move through a course using at least two (2) sensors to stop at a final parking area.

Elaborate

Students can create a maze to have their Edison Robot only using sensors to navigate through autonomously.
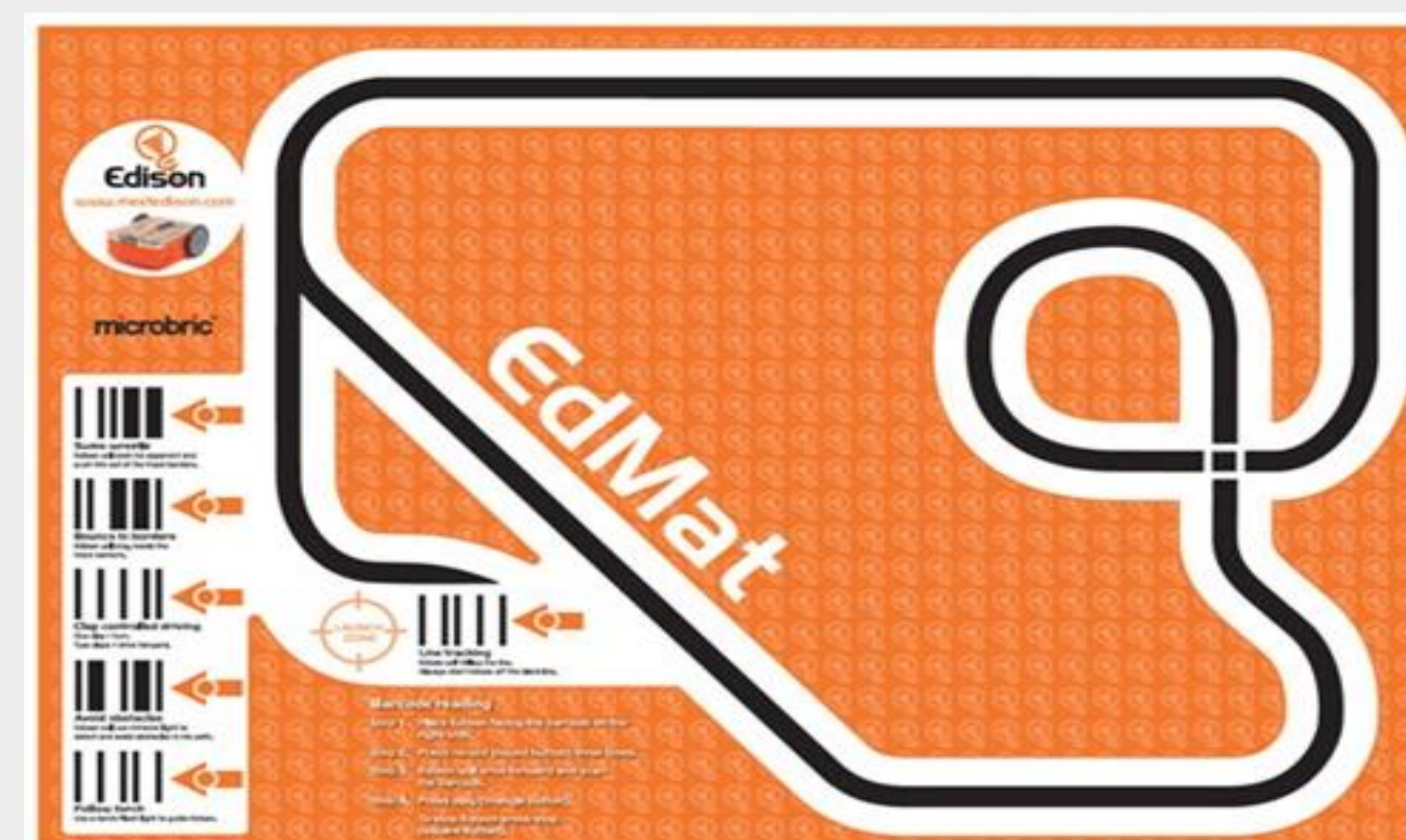
Explain

Concepts explored in this lesson are sensors, algorithms, and loops. Students will learn how to create a code to use two or more sensors simultaneously.

Vocabulary:

Autonomous: Acting independently or having the freedom to do so.
Program: coded instructions for the automatic performance of a particular task.
Algorithm: a process or set of rules to be followed in calculations or other problem-solving operations.
Loop: a programmed sequence of instructions that is repeated until or while a particular condition is satisfied.

Evaluate

Formative Assessment Questions:

What issues did you have when writing the python coding for Edison?
Did you have any errors?
How did you overcome the syntax error?

Summative Assessment:

The culminating project, students will showcase their final project of the robot navigating through the course established by the students and moving from one point to the endpoint showing the sensors Edison is using.

```
1
2    #--------------Setup-----------------
3
4    import Ed
5
6    Ed.EdisonVersion = Ed.V2
7
8    Ed.DistanceUnits = Ed.CM
9    Ed.Tempo = Ed.TEMPO_MEDIUM
10
11   #--------Your code below----------
12   Ed.ReadKeypad()
13   while Ed.ReadKeypad() == Ed.KEYPAD_NONE:
14       pass
15   Ed.Drive(Ed.FORWARD, Ed.SPEED_6,8)
16
```