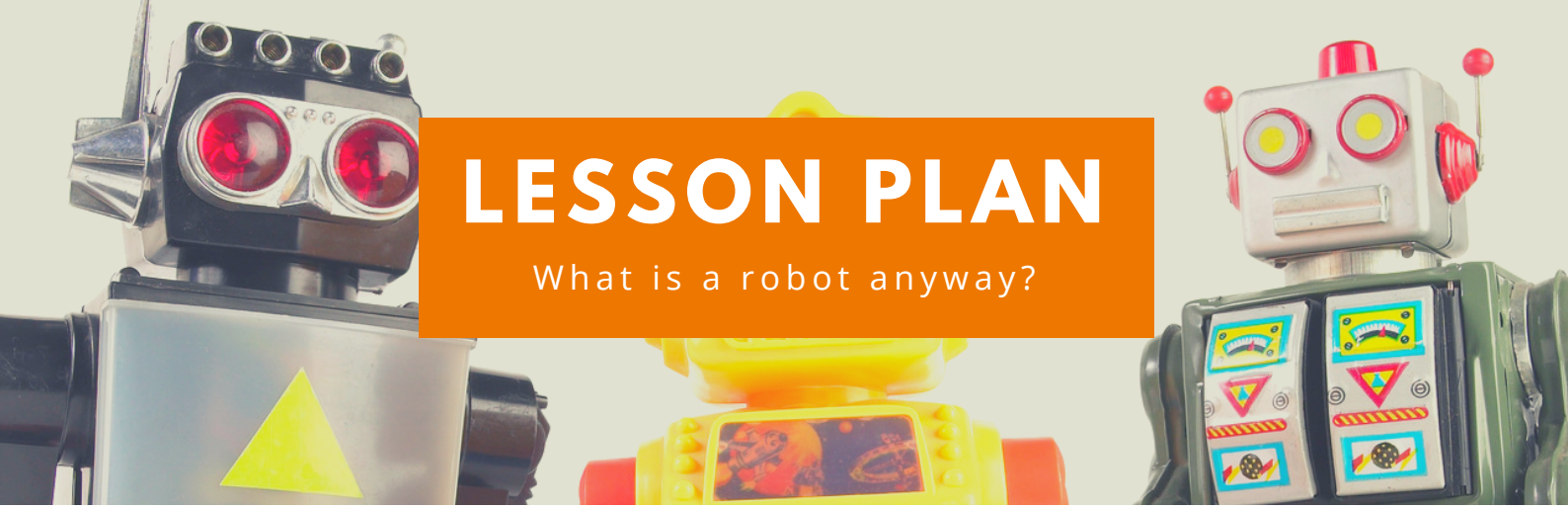


LESSON PLAN

What is a robot anyway?

What is a robot anyway?

An introduction to robotics in the real-world

OVERVIEW

The world is full of robots. From self-driving cars to articulated manufacturing arms to the Mars Rover, robots of all types are becoming more and more a part of modern life.

Investigate what robots are, what they can do and how the representation of robots in fiction differs from real-life robots. Then get hands-on with a robot! Students explore the fundamental robotics concepts of sensors, autonomous behaviour and the input-process-output cycle using one of the Edison robot's pre-set barcode programs, the 'line tracking' barcode program.

START EXPLORING

Kick off this activity by posing the question 'what is a robot?'.

> Hint!
> You may want to use the 'What is a robot?' activity sheet for this part of the activity.

Have students describe what they first think of when they imagine a robot. They can draw a picture or write a description of what they envision independently or discuss their ideas with a partner or small group.

Next, examine the basic definition of a robot: "a robot is a machine that can be made to do a task on its own." Simple as it is, this definition means there are lots of machines in the world that are actually robots!

1. Discuss robots in pop culture and science fiction, such as Disney's WALL-E and the different droids from Star Wars.

2. Explore the many types of robots that exist in the world, such as robotic arms in manufacturing, drones, Roomba-style robotic vacuum cleaners and more. What other examples can you find? What do these different robots do to help people?

3. Compare the differences and similarities between real-world robots and fictional robots. Give special attention to the physical form of the robots, particularly humanoid and non-humanoid designs. How does the shape of these robots help them do their job? What are the trade-offs?

SPECIAL INVESTIGATION:
WHY DON'T MORE REAL ROBOTS LOOK LIKE PEOPLE?

Many of the most memorable robots from fiction are humanoid – that is, they look and function like humans. Classic examples include C-3PO from Star Wars and the Jetsons' robotic maid Rosie. And, yes, it is true that there are some real humanoid robots too. (A great example is ASIMO, the four-foot-tall robot by Honda that can walk, run and perform some basic interactive tasks, like serving food from a tray.) Most of the robots that are gaining traction in the real-world, however, resemble things other than humans.

While humanoid robots are fun to look at, they aren't often practical for the job. ASIMO, for example, requires at least one person (and preferably two) to control it, needs almost a day to set up and can operate for just one hour on its battery before needing a recharge. Compare that to a Roomba vacuum, which operates autonomously, has a longer run time (90-120 minutes) then will automatically return to its home base and recharges itself. A Roomba might not look as fun, but it is a lot more practical for cleaning the floor than ASIMO would be!

DISCOVER A REAL ROBOT

It's time to meet the Edison robot!

While Edison isn't humanoid, it is definitely a robot!

Grab an Edison robot and use it to see how a machine can be made to do a task on its own.

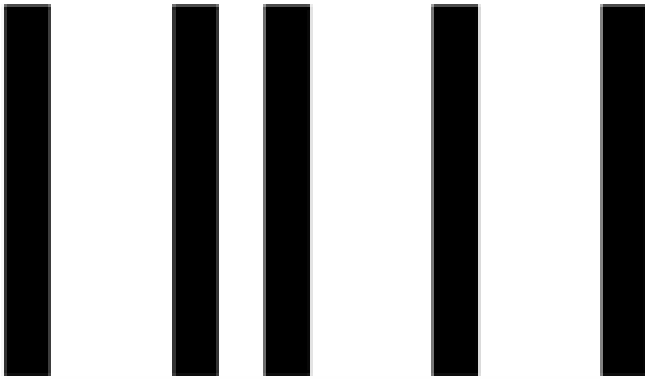
Initially, the definition of a robot might be confusing to some students. How do you get a machine to 'do a task on its own' anyway? The answer is programming, sometimes called coding.

Edison robots can be programmed, which is how we tell Edison what to do. We can program Edison different ways, including by using computers to write code for the robot to follow. Another way to program Edison is by using special barcodes.

Get the Edsion barcodes at www.meetedison.com/barcodes/

This activity uses the 'line tracking' barcode. Before you use the 'line tracking' barcode with the robot, talk with your students about what the barcode does. Explain that Edison comes with some programs already loaded in the robot's memory and that we can get the robot to access and run these programs by using some special barcodes. Tell students you are going to run the line tracking program. Ask what they think the program will get the robot to do.

USE THE LINE TRACKING BARCODE



> **Hint!**
> The EdMat is a great resource to use for this activity: www.meetedison.com/edmat/
> With all the barcodes and a track ready for use, the EdMat makes set-up super easy. The print design will also provide a clue for students as to what the 'line tracking' program does.

Program Edison using the 'line tracking' barcode. Demonstrate the four steps you need to follow whenever you want to use an Edison barcode:

1. Place Edison facing the barcode on the **right side** of the barcode.
2. Press the record (round) button **three times**.
3. Wait while Edison drives forward and scans the barcode.
4. Press the play (triangle) button **one time** to run the program.

> **Hint!**
> Remember to start the robot next to, but not on the black line. The robot needs to start on a reflective (e.g. white) surface for the line tracking program to work correctly.

Run the program and have the students watch as the robot follows the line around the track.
What is happening in the line tracking program? How does the robot detect and then follow the line?

INVESTIGATE LINE TRACKING

> **Hint!**
> Have students look at the Edison robot's line tracker and find the two parts.

Explain to students that Edison robots have different **sensors** that can detect different things. The sensor the robot uses in the line tracking barcode program is called the **line tracking sensor**. This sensor, which is located on the bottom of Edison near the power switch, is made up of two parts: a red LED and a light sensor.

These two parts work together and let Edison 'see' the difference between dark and light surfaces. Edison doesn't see like a human does, however.

INPUT-PROCESS-OUTPUT

Robots like Edison use sensors to detect specific things. The sensor generates data which is **input** to the robot. The robot **processes** the data and determines what to do based on its program. It then creates an **output**.

Edison's line tracking sensor inputs data about the surface beneath the robot. This sensor works by shining light from the red LED onto the surface below the robot. The light sensor then measures how much of that light bounces up from the surface. Edison stores the value of the reflected light as a light reading. The more light that is reflected back to Edison, the higher the light reading.

By measuring how much reflected light is coming from the surface below the robot, the line tracking sensor lets the robot 'see' the difference between dark and light surfaces. Edison cannot see the colour of the surface but can tell if a surface is reflective or non-reflective. A reflective surface will shine back a lot of light from the red LED, and a non-reflective surface will shine back very little light. Edison sees white surfaces as reflective and black surfaces as non-reflective.

When running the 'line tracking' program, the Edison robot uses the line tracking sensor to take lots of light level readings. Edison adjusts direction according to these light level readings. When Edison detects it is on a reflective surface (meaning it is off the line), it turns right to get on the line. However, when Edison is on the line (meaning it detects it is on a non-reflective surface), it turns left to get off the line. This is why Edison 'waddles' back and forth at the edge of the line.

Watching Edison run the line tracking program is interesting because the robot is behaving **autonomously**. This means that Edison is 'thinking' and responding to changes in the environment without any help. Just like Edison doesn't 'see' the way humans do, the robot doesn't 'think' like we do either. Edison is using the data from its sensor and the **input-process-output cycle** to allow it to follow the line.

TEST A DIFFERENT LINE

Ask your students whether or not they think Edison can follow any line using the line tracking program, or just the one you used to demonstrate the program? Have students explain their reasoning. Then put their ideas to the test!

Chances are good that Edison won't be able to follow all of the lines students create. Look at which lines worked and which did not. Compare the lines to each other and the example line. What conclusions can students draw about what makes a good line for Edison's line following program?

Try it!

Get students to create their own lines for Edison to follow. See which lines the robot follows and which it fails to detect. Here are some things to try:

- different coloured lines
- different coloured back grounds
- different line thicknesses
- different curves in the line (varying sharpness of the turns)

SPECIAL INVESTIGATION:
SENSORS AND AUTONOMOUS BEHAVIOUR

The 'line tracking' barcode program is fun, but there's a serious use for programs like this too. Warehouses that use robots to move items around use lines or other markers on the ground to guide the robots to their destination.

To see some incredible robots using this type of sensing and autonomous behaviour in action, look up Amazon's warehouse robots.

SUPPLIES

Required:

- 1 Edison robot
- A demonstration black line
- The 'line tracking' barcode

Got more than 1 Edison robot? Perfect!

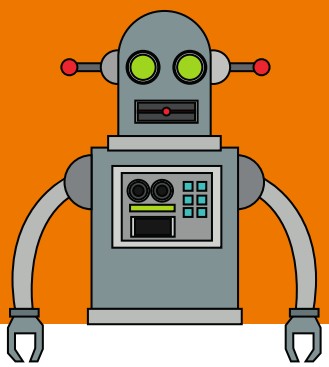
Have each student or group work with their own robot during the demonstration and the line creation challenge.

You can still have groups pool their data about the lines the made and tested as a class, or have each group present their findings to everyone.

Recommended:

- A copy of the 'What is a robot?' activity sheet per student/group
- An EdMat

NOTES:



WHAT IS A ROBOT?

Activity sheet

This is what I imagine when I think of a robot:

A robot is a machine that can be made to do a task on its own. There are many types of robots. Different robots can do different things. What kinds of robots are there and what can they do?

Robots in fiction:

Robots in the real world: