

LESSON 7

Line Following Car

60 minutes (2 periods)

Programming Car Behaviours

WHAT THIS LESSON DOES

In this step-by-step lesson, you'll learn to program a Move Motor Car to follow a line track using a Microbit. You'll create a new project, add an extension, create variables, and set up LEDs. You'll then program the car to turn right, left, and move forward. Finally, you'll test your car on a track and tweak the code for optimal performance.

WHAT STUDENTS SHOULD BE ABLE TO DO

- Understand and apply the concept of programming a Microbit to control a Move Motor Car.
- Create and manipulate variables to store sensor values and control the car's movements.
- Implement conditional logic to guide the car's movements based on sensor readings.
- Use LEDs for visual feedback and enhance the functionality of the car.
- Experiment with code modifications to optimise the car's performance on different tracks.

BEFORE THE BELL

- Count out one Move Motor car per pair with four fresh AA batteries fitted, one micro:bit and one USB cable each. Power-check every car the day before.
- Print or draw thick black line tracks (attachment mbmmlfc tiles.pdf, or marker on paper) and lay them flat where cars can run.
- Open <https://makecode.microbit.org> on the school network and confirm students can create a project and add extensions.

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HOW THE LESSON RUNS

Introduction
Create a new project
Add the extension
Create the variables
Setup the LEDs
Turn right
Turn left
Go forwards
Test it on a track
Tweak the code

TEACHING MOVES

- 1. Introduction. Hold up the car and track. Name each item they need: micro:bit, car, USB cable, black line. Stress thick, clear lines if anyone is drawing their own.
- 2. Create a new project. Get everyone to makecode.microbit.org and a blank project before anyone codes. Wait until every pair has a named project open.
- 3. Add the extension. Show Extensions, search kitronik-move-motor, and add it. Ask them to find the new MOVE Motor blocks in the toolbox before moving on.
- 4. Create the variables. Create left, right and difference together. Say out loud what each stores: left sensor, right sensor, and left minus right.
- 5. Setup the LEDs. Add the LED setup so colour feedback is ready. Tell them yellow, red and the forward colour will show which branch is running on the track.
- 6. Turn right. Walk the condition: difference greater than 10 means the left sensor is darker, so stop the right motor and spin the left. Flash yellow on the LEDs.
- 7. Turn left. Mirror it for difference less than -10: right sensor darker, stop left motor, spin right, LEDs red. Check both branches sit inside the forever loop.
- 8. Go forwards. Fill the else: similar readings mean drive both motors forward. Remind them this is the default when the line sits between the sensors.
- 9. Test it on a track. Download to the micro:bit, seat it in the car, and line the track under the middle so sensors sit either side. Power on and watch one full lap before tweaking.
- 10. Tweak the code. Once a lap works, change speeds or thresholds only one at a time. Time laps and compare who stays on the line at higher speed.

WHAT TO WATCH FOR

- Students treat any movement as success, even when the car leaves the line or spins in place. Ask them to watch the LEDs and name which branch is firing. If it is not matching the line position, fix sensor placement or the threshold before changing speed.
- Students reverse left and right: darker on the left should turn right, but they turn the wrong way. Put the car on a straight line, cover one sensor with a finger, and predict the turn before they run it. Match the prediction to the motor they stop.
- Students set the difference threshold so tight or so loose that the car chatters or never corrects. Start at greater than 10 and less than -10 as in the lesson. Change only one number, test a lap, then decide.

DIFFERENTIATION

- Emerging: Pair them with a group whose car already follows a straight section. Have them build left, right and difference first, then one turn branch. Stand with them at download and track placement: line under the car centre, sensors either side, before they judge the code.
- Developing: Prompt them to say which LED colour they expect on a left bend, then run it and compare. If forward works but turns fail, ask which motor should stop for a right turn and check that block only.
- Proficient: Challenge them to raise speed and retune the difference threshold so the car still completes a timed lap. Have them design a tighter track and adjust code until it stays on without further help.