

Lesson 5

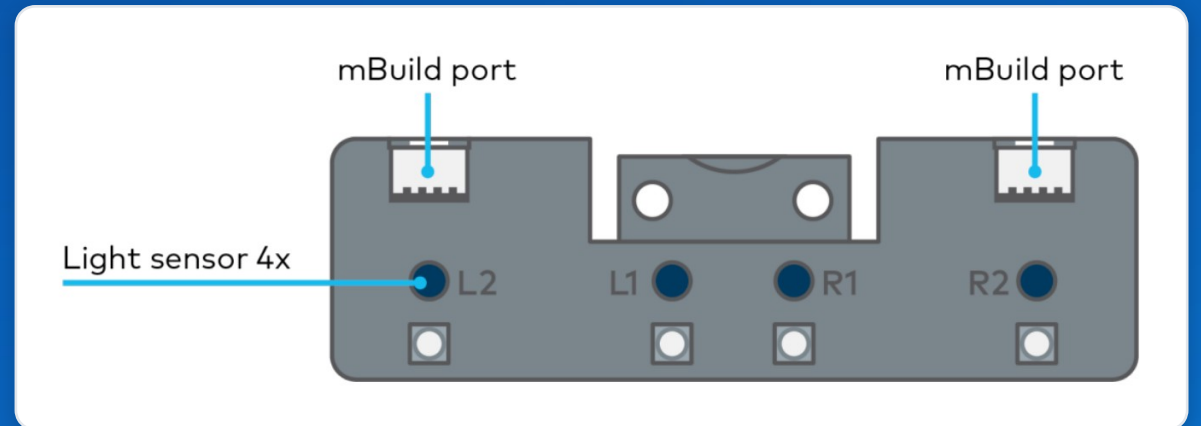
Sightseeing!

Your robot becomes a tour bus

STEAM · 45 minutes · Beginner

Today mBot2 turns into a sightseeing coach that drives its own route.

It follows a black line around a city map all by itself. At each colored landmark it stops and does something special!



What You Will Be Able To Do Today

1

Explain how color sensors work

2

Spot where color sensors are used in everyday life and in robots

3

Make the mBot2 follow a line all on its own

4

Make the mBot2 do different actions depending on the color it sees

Color Sensors Are Everywhere Around You

- Color sensors detect light intensity and colors
- A warehouse robot finds its route by following colored floor markings
- Car factories use a color meter to check the paint is exactly the right shade
- Anywhere precise color matching matters, a sensor does the checking

Your turn

Name other machines that might need to see color.

RGB Means Red, Green and Blue Mixed

- A color sensor has three tiny sensors inside it
- They measure the Red, Green and Blue light reflected off an object
- Every color becomes three numbers — a special mix that names that color
- That is why they are called RGB sensors
- Change the mix and you get a completely different color

Just like...

Mixing paint! Three primary colors combine to make any shade you want.

mBot2 Has Four RGB Sensors In One



- The four sensors are named L1, L2, R1 and R2 — L for left, R for right
- They compare the reflected color mix against built-in presets automatically
- So the sensor just reports the color — you never handle RGB codes yourself
- It detects 6 colors plus black and white, and also greys, lines and junctions
- Four sensors side by side is what makes line following possible

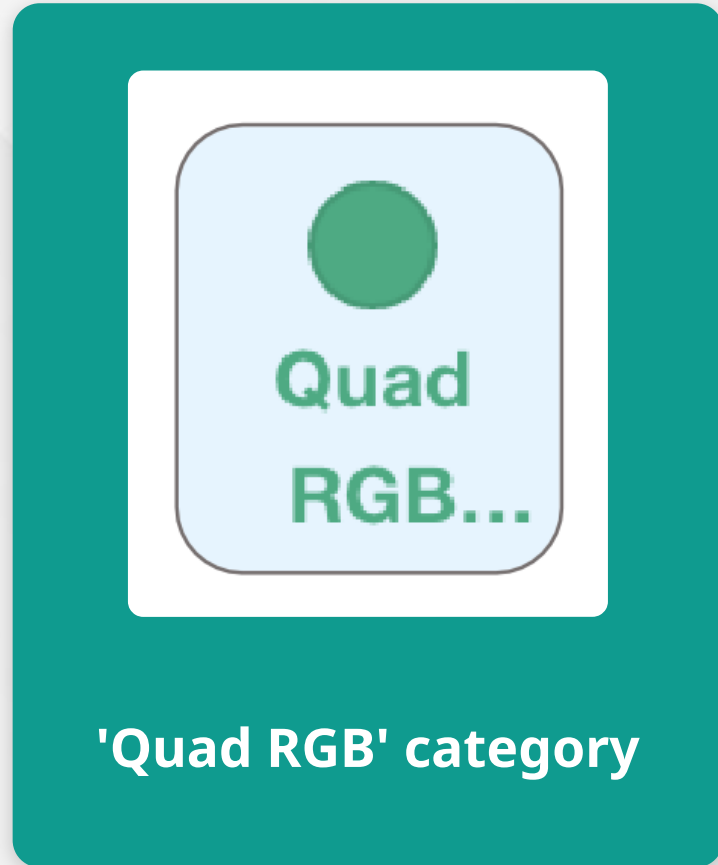
Calibrate The Sensor With A Double-Click

- The little button on top of the sensor is for calibration
- Double-click it and the LEDs start flashing
- Now swipe the robot across the line you want it to follow
- This teaches the sensor to tell the line apart from the background
- A black line on white paper usually needs no calibration

Important

On the color map, calibrate to the yellow section.

The Green Quad RGB Blocks



- Find these blocks in the 'Quad RGB' category in mBlock
- They are green — easy to spot in the block area
- The first four blocks are for identifying the line
- They handle simple following, plus crossings and sharp 90° turns
- LEDs off means a dark line spotted; LEDs blue means bright background

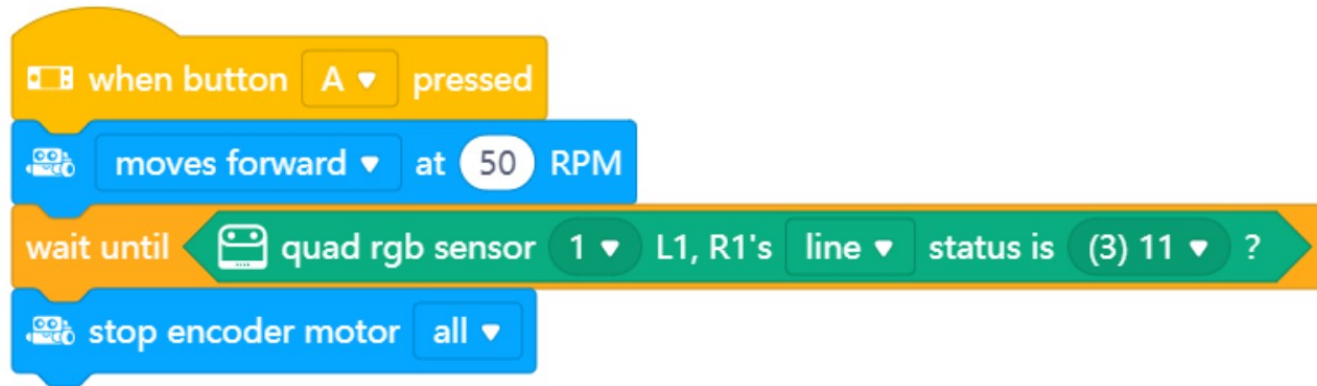
Two Inner Sensors Give Four Answers

 quad rgb sensor 1 ▼ L1, R1's line ▼ status is (3) 11 ▼ ?

 quad rgb sensor 1 ▼ L1, R1's line ▼ status (0~3)

- These blocks use only the inner two sensors, L1 and R1
- Status 0: on white background, both LEDs on, no line
- Status 1: only R1 sees the black line
- Status 2: only L1 sees the black line
- Status 3: both inner sensors are on the line — dead centre
- Use the first block inside an if; use the second to show the value on screen

First Program — Stop When You Reach The Line



- Press A and the robot drives forward at 50 RPM
- 'wait until' pauses everything until the line status becomes 3
- Then all motors stop
- Reacting while driving is time-critical, so use Upload mode
- Try it in both modes and feel the difference

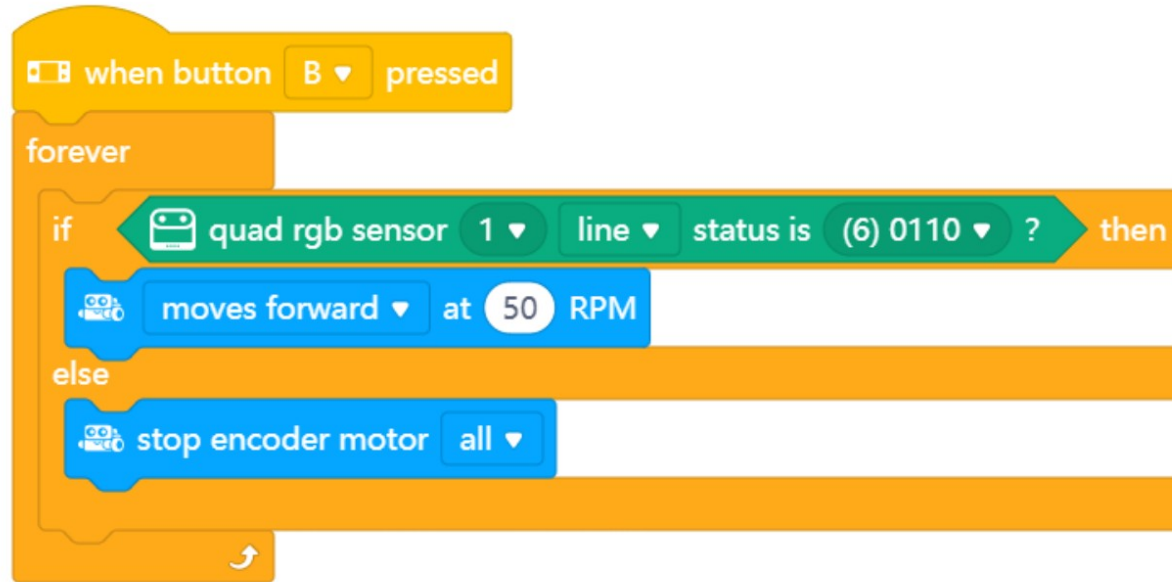
All Four Sensors Can Spot Junctions

 quad rgb sensor 1 ▼ line ▼ status is (15) 1111 ▼ ?

 quad rgb sensor 1 ▼ line ▼ status (0~15)

- Same logic, but now all four sensors are watching
- Four sensors means 16 possible statuses instead of 4
- 0110 means the two inner sensors are on the line — going straight
- 0111 is a sharp turn right; 1110 is a sharp turn left
- 1111 is a T-junction, lines going both ways
- Find an X-junction by driving over the T and checking if the line continues

Drive While The Line Lasts



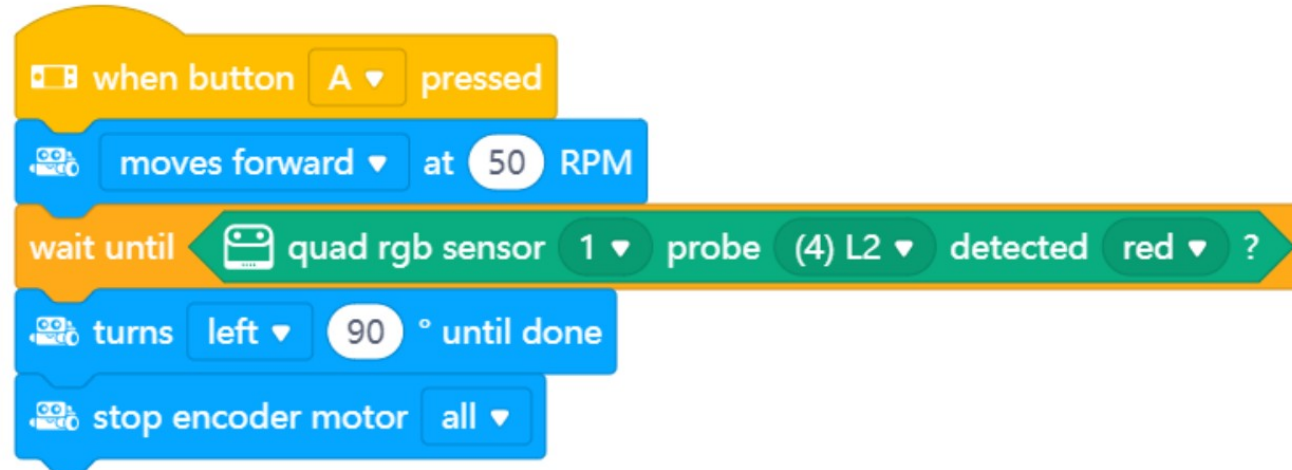
- The robot keeps driving as long as the inner two sensors see the line
- It stops if it goes off track
- It stops if a junction is detected
- It stops if the line suddenly ends
- One program, three different reasons to halt

One Sensor Can Watch For A Marker



- Pick one sensor — L2, L1, R1 or R2
- Ask it for line, background, white, black, or one of 5 colors
- The 5 colors are red, green, blue, yellow, cyan and purple
- For line following, use the earlier blocks — they check several sensors at once
- Use this block to spot a color marker beside the track while still driving

React To A Red Marker While Driving



- Press B and the robot drives straight along the line
- It keeps checking the left side for a red marker
- Red spotted means make a 90° turn
- This is how a tour bus knows it has arrived at a landmark
- Build it and test with a red card beside your track

Smooth Steering With The Deviation Block



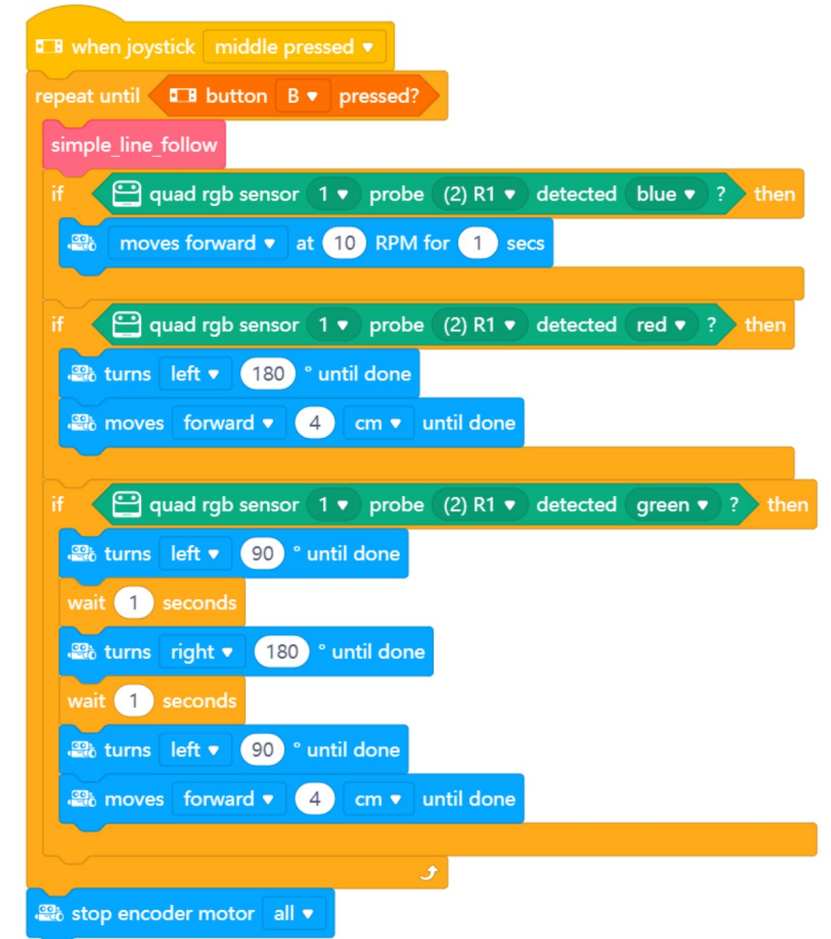
- This block measures how far off the black track the robot is
- The earlier blocks only knew three states: on track, off left, off right
- Riding a bike, you steer a little for a gentle curve and a lot for a sharp one
- This block lets the robot do the same — proportional steering
- Deviation of 0 means dead centre, so steering is 0 and it drives straight

Your Mission

A Tour Bus With Landmark Stops

- The mBot2 becomes a tour coach following the black line on the map
- Colored areas — red, yellow, green, blue — mark the sights
- You invent what happens at each one: a song, a spin, a greeting
- Driving through Paris? Play the French anthem. London? Big Ben chimes
- Tidy your code with red 'My Blocks' — bundle line following into simple_line
- After each action, drive 4 cm forward so the same color isn't read twice

25 minutes



Showtime and Wrap-Up

- Did your coach complete the tour around the track?
- Film a short, fun movie of your robot on its route
- Reflect: What turned out well? What could be better?
- Which parts were easy, and which were tricky?
- What do you want more explanation about, and who could help you?

Today you learned

- How the Quad RGB sensor works
- How to follow a line all on its own
- How to act on the colors it sees