

Lesson 2

Sensing = Data

STEAM • 45 minutes • Beginner

Today your robot becomes a scientist.

mBot2 has senses. You'll make it measure light, sound, tilt and time — then show the numbers right on its own screen as it drives around the room.



What You Will Be Able To Do Today

1

Name the sensors on mBot2 and say what each one measures

2

Use the code blocks that read each sensor

3

Show sensor data on the CyberPi screen — as text, a chart or a table

4

Explain the difference between Live mode and Upload mode

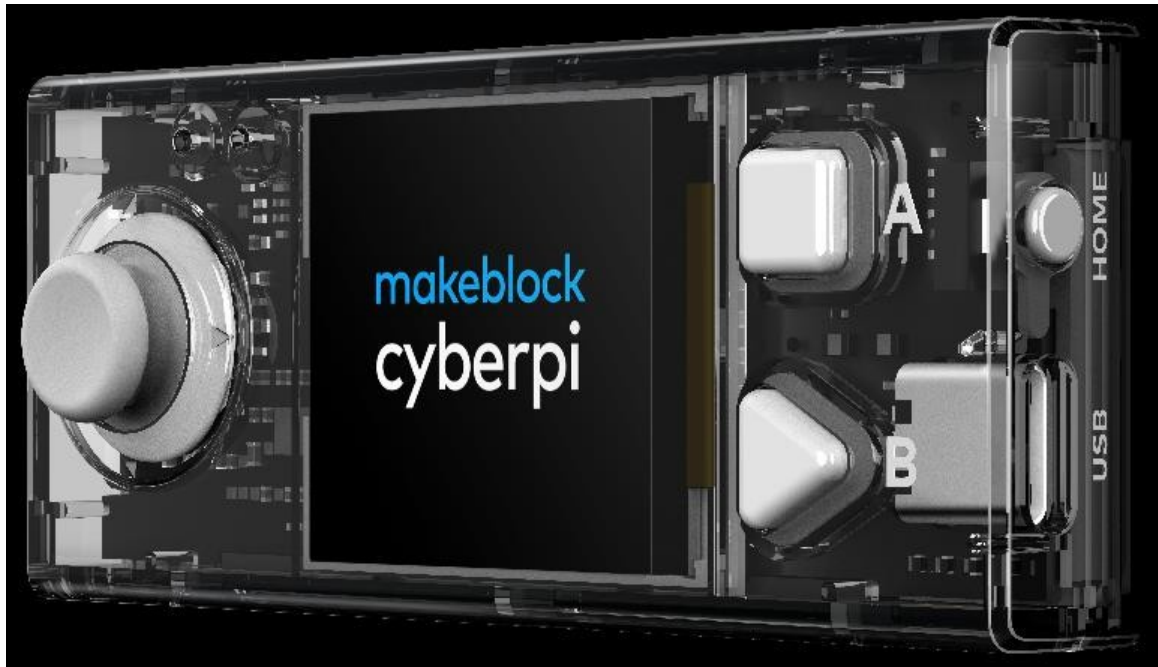
Sensors Are Everywhere

- A sensor is a device that measures something in the world and turns it into a number
- Outdoor lights switch on by themselves when a sensor notices it's getting dark
- The heating turns off when a sensor notices the classroom is too warm
- Your phone dims its screen in a dark room — that's a light sensor
- Everything a sensor records is called data

Your turn: name another everyday machine that uses a sensor

Sensor = a robot's sense. Data = what the sense records.

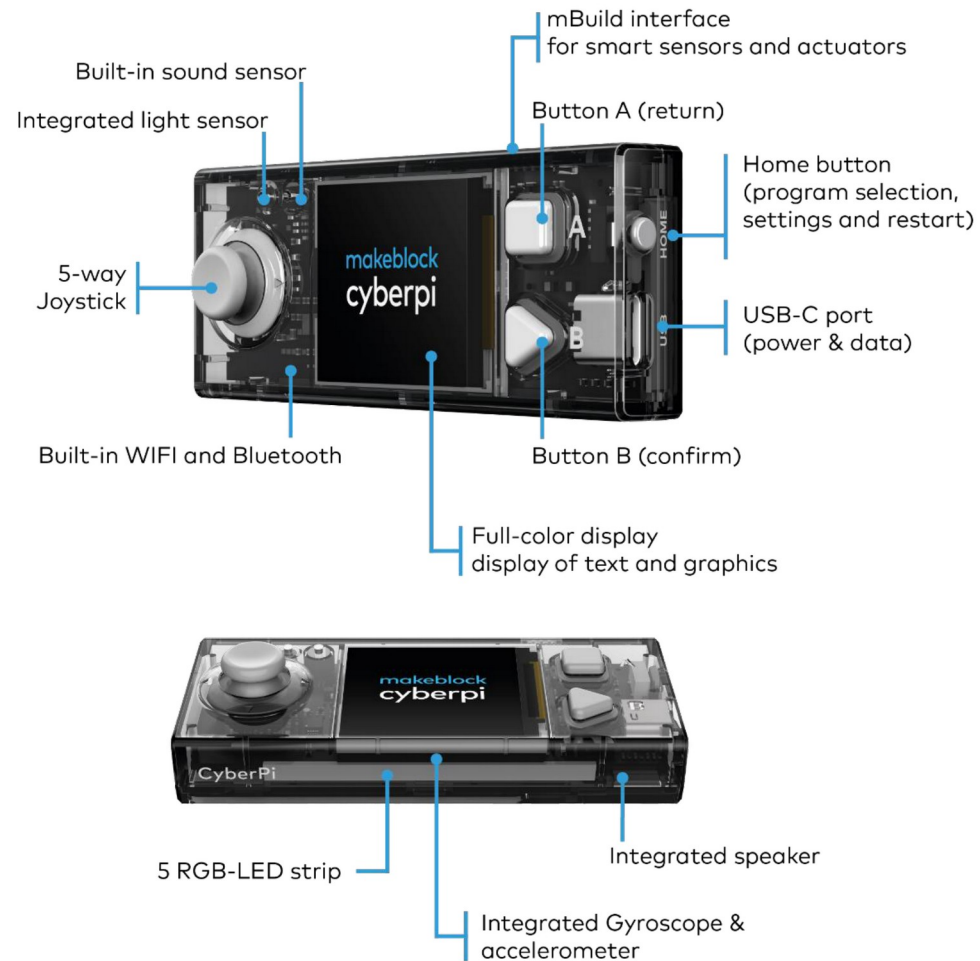
The CyberPi Is The Robot's Brain



- The CyberPi is a small programmable microcomputer
- It sits on top of mBot2 — and you can lift it off
- You write blocks in mBlock, and they go to the CyberPi
- The CyberPi then tells mBot2 what to do
- It also has its own screen, speaker, microphone and joystick

You → mBlock → CyberPi → mBot2

Everything Packed Into The CyberPi



- Built-in light sensor
- Built-in sound sensor (microphone)
- Gyroscope & accelerometer
- Full-colour display
- 5 RGB-LED strip
- Speaker
- 5-way joystick, buttons A and B
- Wi-Fi and Bluetooth

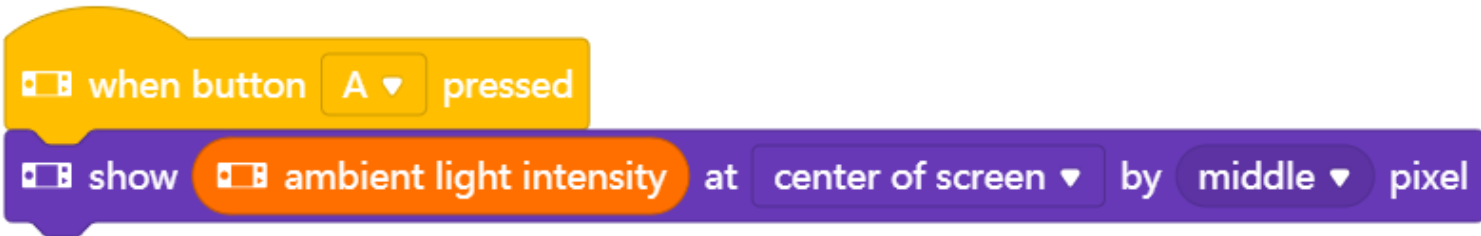
Hands-on

Meet The Five Senses

- Light sensor · Sound sensor · Gyroscope & accelerometer
- Ultrasonic sensor · Quad RGB sensor · Timer
- Each one comes with a block you can try right now

10 minutes

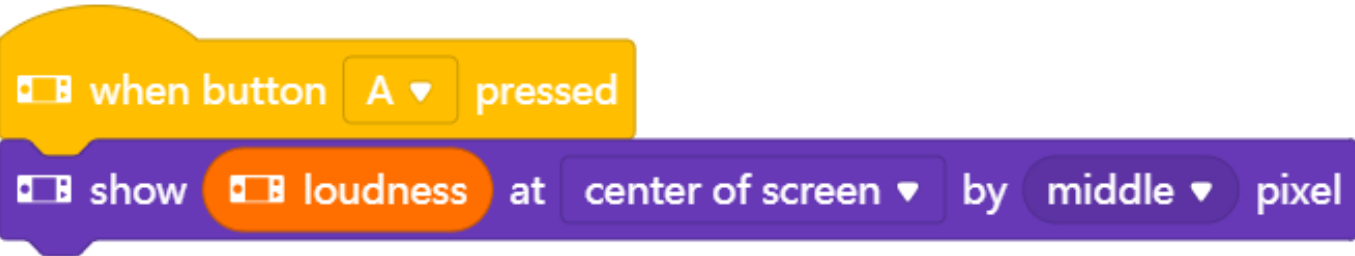
Sense 1 — The Light Sensor



- Light carries energy, and this sensor turns light energy into electrical energy
- Phones use it to adjust screen brightness automatically
- Cars use it to switch on the headlights when it gets dark
- This program shows the light level in the middle of the CyberPi screen

Try it: cover the sensor with your hand and watch the number drop

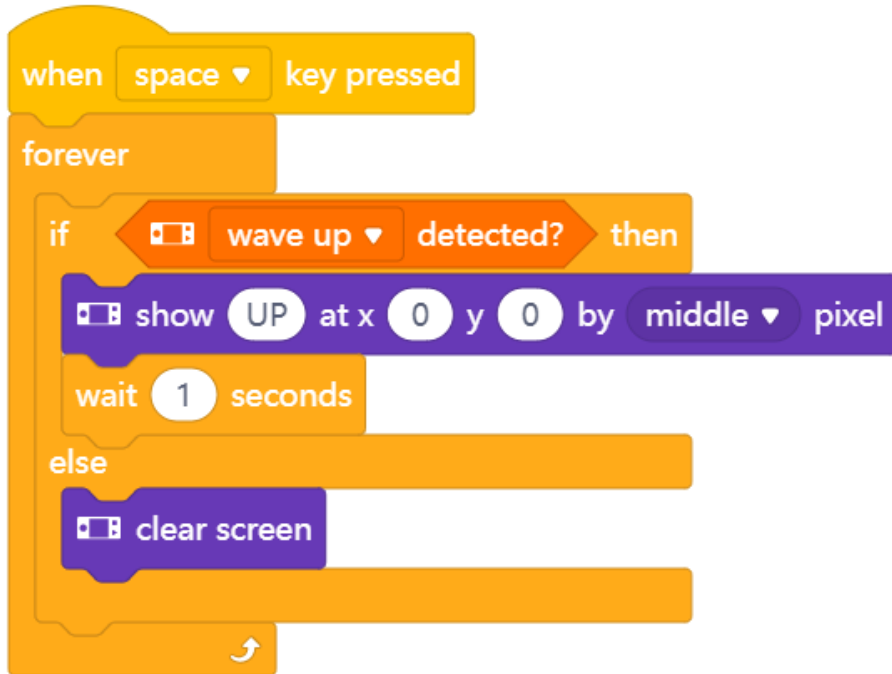
Sense 2 — The Sound Sensor



- Sound is a vibration that travels through the air as waves
- We hear vibrations between about 16 and 20,000 per second
- How powerful the sound is = the sound intensity, or loudness
- The microphone turns sound into an electrical signal the robot can measure
- Used for phone calls, recordings, and voice assistants

Try it: whisper, then clap — watch the loudness number jump

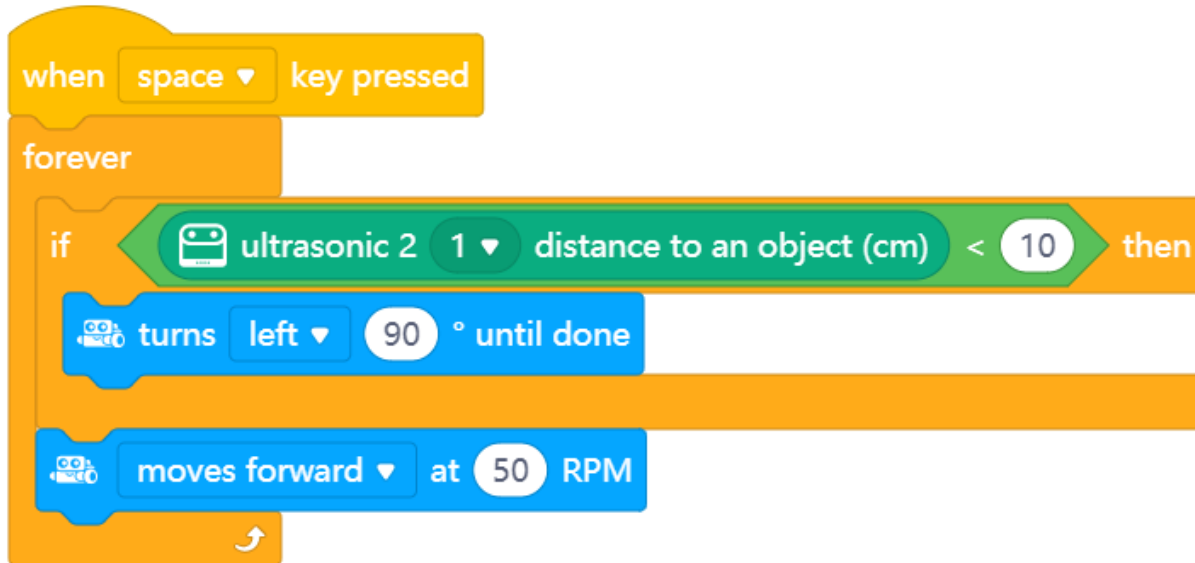
Sense 3 — Gyroscope & Accelerometer



- A gyroscope measures tipping and turning movements
- An accelerometer measures changes in speed
- Together they tell the robot how it is positioned in space
- Gyroscopes keep ships steady at sea and balance a hoverboard
- Accelerometers know if your phone is face up or face down — and fire a car's airbags in a crash
- This program shows UP on the screen when you wave the robot upwards

You'll go much deeper into this sensor in Lesson 6

Sense 4 — The Ultrasonic Sensor

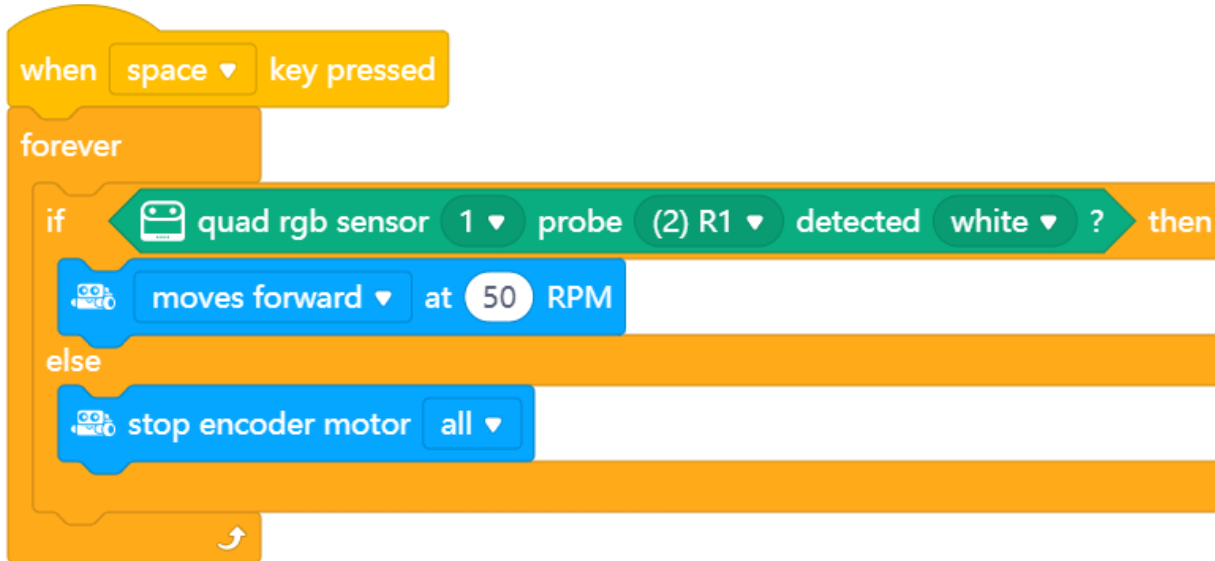


Echo = sound bouncing back

You'll go much deeper into this sensor in Lesson 4.

- Sound travels through air at about 334 metres per second
- Very high vibrations we cannot hear are called ultrasound
- Send out a sound, time how long the echo takes to come back — that gives you the distance
- Used in hospital ultrasound scans, and in robots to avoid crashing
- This program turns 90° left whenever an obstacle is closer than 10 cm

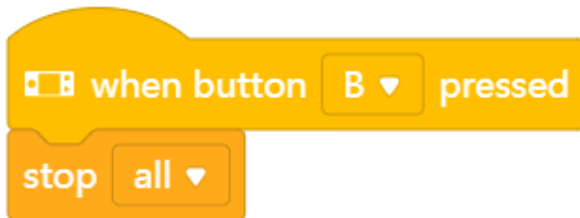
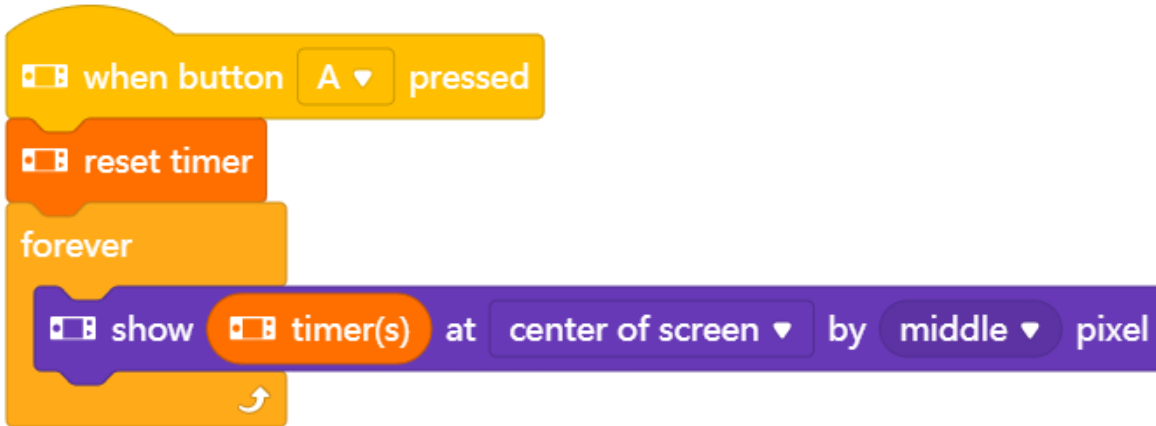
Sense 5 — The Quad RGB Sensor



You'll go much deeper into this sensor in Lesson 5.

- Four little light-and-colour sensors side by side
- Each measures how much red, green and blue light comes back
- That lets the robot recognise colours on the ground
- And it lets the robot follow a black line
- Warehouse robots use coloured paths; paint factories check colours are exact
- This program drives forward while the sensor sees white, and stops otherwise

Sense 6 — The Timer



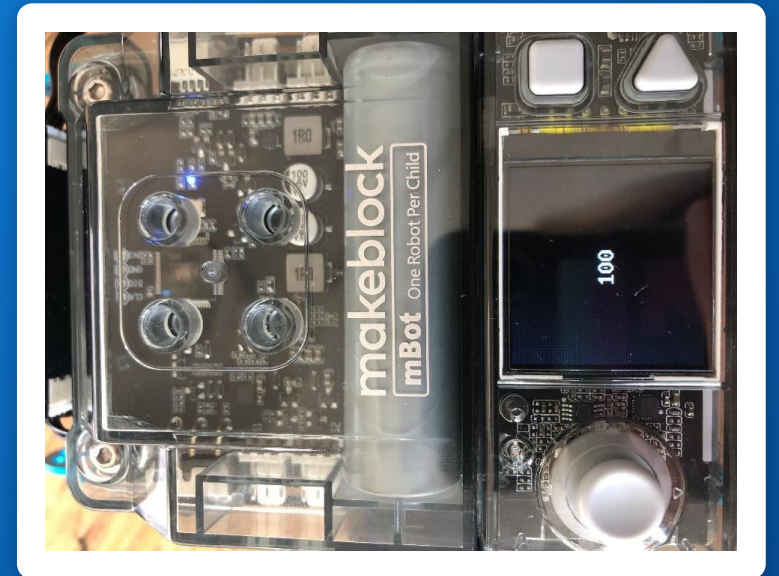
Race them!

- The timer is a stopwatch counting seconds since the CyberPi switched on
- You can reset it to zero whenever you like
- Button A resets the timer and shows it on the screen forever
- Button B stops everything
- Perfect for racing several mBots and timing them to the finish line

Showing Your Data

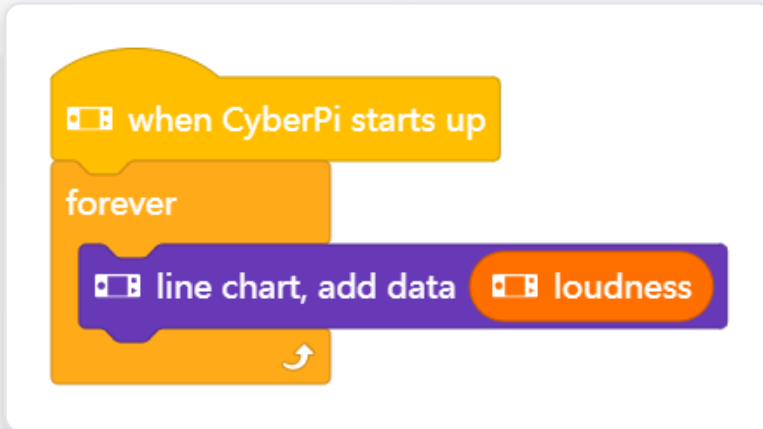
Numbers, Charts And Tables

- Everything a sensor records is data
- The 'Display' category in mBlock has blocks to put data on the screen
- You can show it as text, as a line chart, or as a table

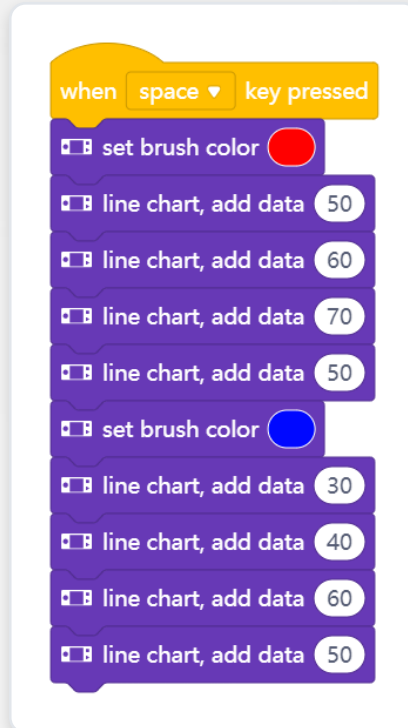


Three Ways To Show Data On The Screen

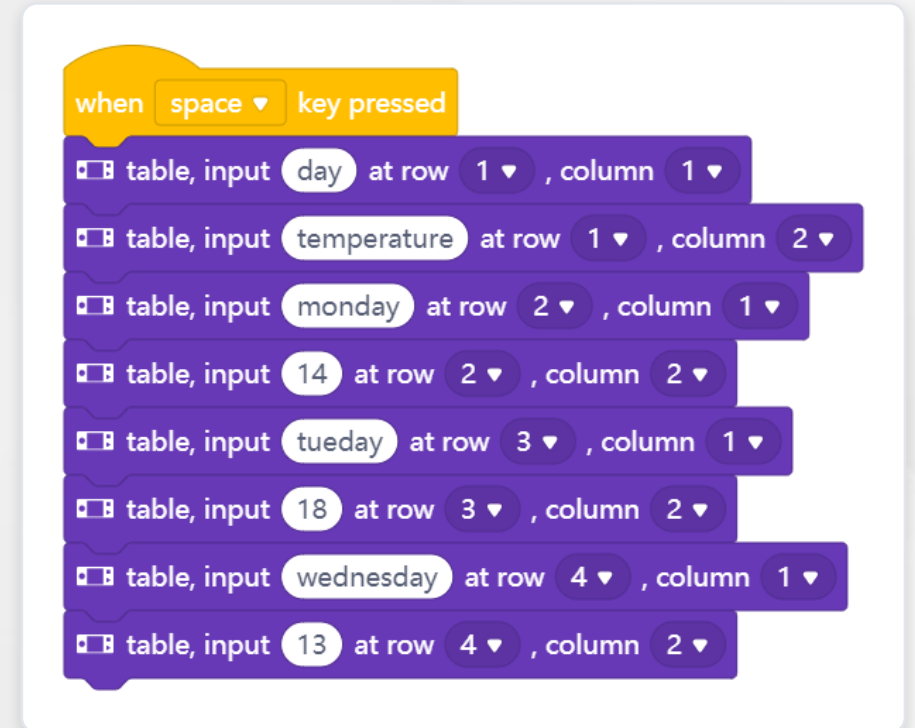
Live line chart



Coloured line chart



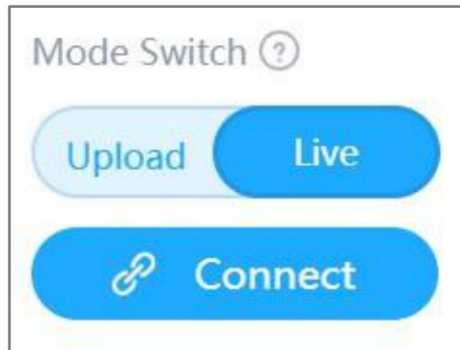
Table



- Chart = watch one value change over time
- Colours = compare two sets of numbers
- Table = neat rows and columns, just like a spreadsheet

Build all three and test them in Live mode

Live Mode Or Upload Mode?



Flip the Mode Switch at the top right of mBlock

LIVE mode

- Program runs on your computer
- Nothing is saved on the CyberPi
- The CyberPi must stay connected
- mBlock must stay open
- Used for programming with the stage
- Great for testing as you build

UPLOAD mode

- Program runs on the CyberPi itself
- It is saved on the CyberPi
- No cable needed
- mBlock can be closed
- Stays there until you replace it
- Great for a robot that roams free

Never unplug the CyberPi while testing in Live mode!

Your Mission & Wrap-up

Be A Robot Scientist

- Drive mBot2 around the classroom or school and collect data as it goes
- You choose what to measure and how to show it on the screen
- Plan first: what route, what data, which blocks, how to display it
- Then test, note what to improve, and fix it until it works
- Film the result and share it with the hashtag #mBot2data

Reflection

- What worked well?
- What could be better?
- What was easy, what was tricky?
- What needs more explaining?
- Who could help you?

25 minutes hands-on · 5 minutes reflection