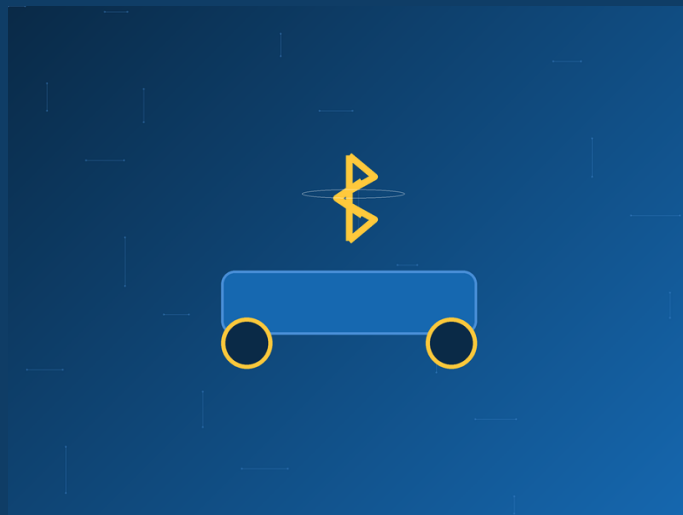


STAGE 3

Bluetooth-Controlled Robot

Drive your robot from your phone over Bluetooth, using a Raspberry Pi Pico and HC-05 module.



Skill level: Advanced

Recommended age: 13+

Hands-on builds: 4

What you'll build

This manual walks through assembling and programming the **Stage 3: Bluetooth-Controlled Robot** step by step, alongside a full materials list and the original circuit diagram. It's a companion to — not a replacement for — the kit's original build guide, which is linked from the product page for reference.

#	Project	What it teaches
1	Motor driver wiring	Wire all 4 BO motors to the L298N driver board so the Pico can control direction and speed for each side.
2	Bluetooth link	Connect the HC-05 module to the Pico's UART pins and pair it with a phone over Bluetooth.
3	Command parser	Write the MicroPython script that reads incoming Bluetooth bytes and maps them to motor functions.
4	App-controlled robot	Install the companion Android app and drive the finished robot live from your phone.

Note: The companion Android app is available at: https://stemschoolprogram.com/APK/BT_Robot.apk

What's in the box

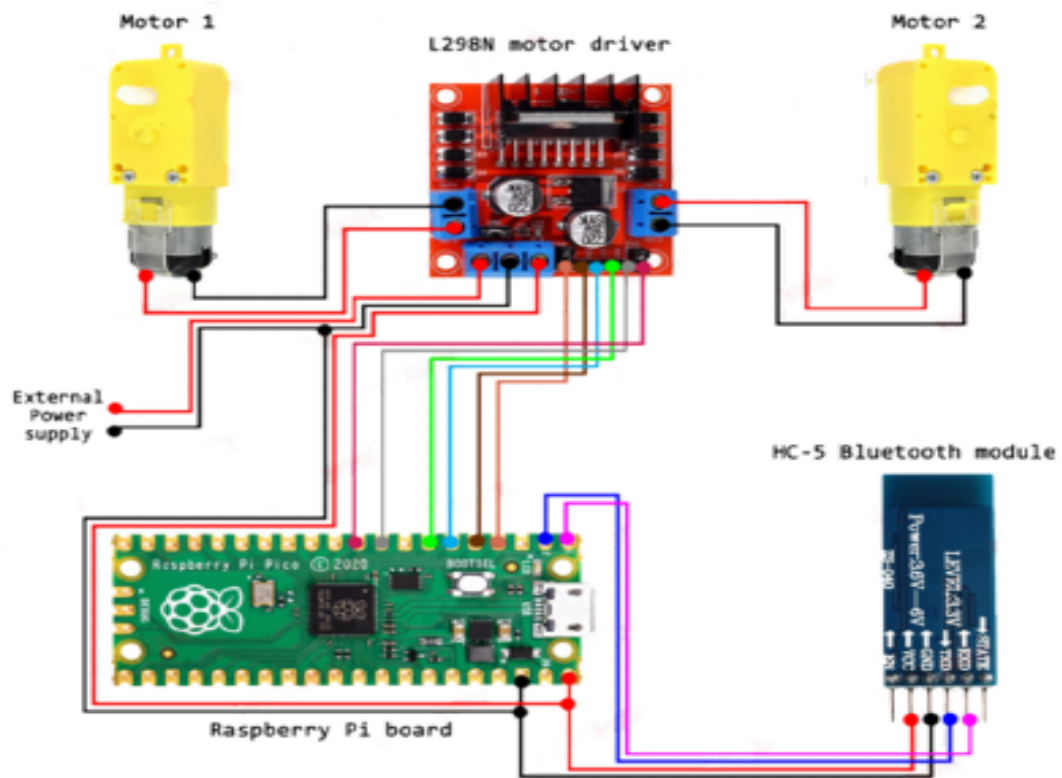
13 line items. Check every part against this list before you start building.

Item	Qty	What it's for
Raspberry Pi Pico	1	The microcontroller — runs the MicroPython program that controls the robot.
L298N motor driver	1	Lets the low-power Pico safely switch the higher-current motors on, off, and in reverse.
HC-05 Bluetooth module	1	Receives commands wirelessly from a phone and passes them to the Pico over UART.
300 RPM BO motor	4	Geared DC motors that drive the wheels.
Wheels	4	Attach directly to the BO motor shafts.
Robot chassis	1	The frame every component mounts to.
Jumper wires	30	Wire components together on the breadboard and driver board.
18650 Li-ion 2500mAh battery pack	1	Rechargeable power source for the motors and electronics.
Battery holder	1	Holds the 18650 cells securely.
Breadboard	1	Prototyping surface for the sensor and driver wiring.
Data cable (type B)	1	Connects the Pico to a computer to upload the MicroPython code.
Double-sided foam tape	1	Secures the breadboard and modules to the chassis.
Companion app	Free Android APK	Sends U/D/L/R/S drive commands to the robot over Bluetooth.

Step-by-step build instructions

1	Assemble the chassis Mount all 4 BO motors and wheels onto the robot chassis.
2	Wire the motor driver Mount the L298N to the chassis and wire Motor 1 and Motor 2 to its OUT1-OUT4 terminals exactly as shown in the circuit diagram on page 4.
3	Wire the driver to the Pico Connect the L298N's ENA, IN1-IN4, and ENB pins to the Raspberry Pi Pico's GPIO pins 2-7 (see the wiring diagram for exact pin numbers).
4	Wire the Bluetooth module Connect the HC-05's TX/RX pins to the Pico's UART0 pins, crossing them: HC-05 TX to Pico RX, and HC-05 RX to Pico TX.
5	Connect power Wire the battery pack to the L298N's power input, and make sure the Pico, L298N, and HC-05 all share a common ground.
6	Flash MicroPython If you haven't already, install Thonny on your computer and flash the MicroPython firmware onto the Pico.
7	Upload the code Copy the Python code on page 6 onto the Pico as main.py and run it.
8	Pair the app Install the companion app from the link on page 6 and pair your phone with the HC-05 module (default PIN is usually 1234 or 0000).
9	Test every command Send Up, Down, Left, Right, and Stop from the app and confirm the robot responds correctly to each one.

Circuit diagram



MicroPython code

Copy this onto the Raspberry Pi Pico as main.py using Thonny (or your preferred MicroPython IDE), then run it.

```
# Include the library files
from machine import UART, Pin, PWM
from time import sleep

# Set the motor driver pins as output pins
ENA = PWM(Pin(2))
IN1 = Pin(3, Pin.OUT)
IN2 = Pin(4, Pin.OUT)
IN3 = Pin(5, Pin.OUT)
IN4 = Pin(6, Pin.OUT)
ENB = PWM(Pin(7))
uart = UART(0, 9600)

# Speed of this car
speed = 65025 # 0 - 65025
ENA.duty_u16(speed)
ENB.duty_u16(speed)

def forward():
    IN1.on(); IN2.off()
    IN3.on(); IN4.off()

def backward():
    IN1.off(); IN2.on()
    IN3.off(); IN4.on()

def left():
    IN1.on(); IN2.off()
    IN3.off(); IN4.on()

def right():
    IN1.off(); IN2.on()
    IN3.on(); IN4.off()

def stop():
    IN1.off(); IN2.off()
    IN3.off(); IN4.off()

while True:
    if uart.any():
        value = uart.readline()
        print(value)
        if value == b'U':
            forward()
        elif value == b'D':
            backward()
        elif value == b'L':
            left()
        elif value == b'R':
            right()
        elif value == b'S':
            stop()
```

Troubleshooting

Symptom	Fix
A motor spins the wrong way	Swap its two wire connections at the driver board or switch.
Nothing powers on	Check battery orientation first, then confirm every switch or connector is fully seated.
Bluetooth won't pair (Stage 3)	Confirm the HC-05's LED is blinking (pairing mode) and try the default PIN, 1234 or 0000.
Pico isn't recognised by your computer	Hold the BOOTSEL button on the Pico while plugging in the USB cable, then release it once connected.
Line follower loses the line on curves (Stage 4)	Lower the sensor height slightly, slow the motor speed, or widen the gap between the two sensors.
Ultrasonic sensor gives erratic readings (Stage 5)	Make sure nothing else is close enough to cause echo interference, and double-check the Trig/Echo pins aren't swapped.

Need more help? Email our STEM instructors or visit the FAQ at streamedutech.com. The original source build guide for this kit (with the manufacturer's own circuit reference) is linked from this kit's product page alongside this manual.