

# Circular robot platform

CB02 / revision 0.2 / 29 September 2026 / USD

## Bill of materials & procurement notes

A common circular drive base with a removable character interface. The screen, arm servos, microphone and speaker remain in the upper body. Dimensions are provisional and now follow the components.

| Cost scope                                 | USD      |
|--------------------------------------------|----------|
| Priced selected hardware                   | \$209.13 |
| Printing / completion allowance (estimate) | \$34.00  |
| Planning subtotal, plus unpriced items     | \$243.13 |

## Changes from the first study

Two Pololu 5138 encoder gearmotors replace the discontinued right-angle motor. A bought-in 32 mm wheel pair replaces printed hubs and tyres. One forward VL53L1X and two downward VL53L4CD carriers replace the optional single range sensor.

## Procurement status

This is a priced candidate configuration, not a released shopping list. New Pololu pages show backorders; verify delivery dates before ordering. Encoder cables are required and not yet priced. Unchanged prices are carried forward from the same-date source research.

## Not included

Shipping, tax/duties, tools, custom PCB design/fabrication, character shell, labour and firmware. The \$34 allowance is a rough provision for printing and completion, not an itemised fastener quotation.

## Electrical hold

The 1S 1200 mAh battery and 5 V boost remain packaging candidates. Combined servo, drive, audio and radio peaks are not validated. Use the charger only with robot loads disconnected; do not parallel the XIAO charger. Final power path, protection and GPIO mapping are future work.

# Drive and sensing hardware

Supplier links are clickable. Prices are per stated purchase unit, not per model instance.

| Component / source                                                                                                                                                                                                    | Qty    | Each    | Total   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|---------|---------|
| <b>B01 · 100:1 MP 6 V micro metal gearmotor with encoder</b><br><a href="#">Pololu 5138</a><br>12 CPR encoder, back connector. 220 rpm no-load / 0.67 A stall at 6 V. Cable sold separately; budget and GPIO pending. | 2 each | \$29.95 | \$59.90 |
| <b>B02 · 3/8-inch plastic ball caster</b><br><a href="#">Pololu 950</a><br>Official caster STEP, 13.5 mm hole pitch. Model includes fused ball/housing; purchased mechanism rotates freely.                           | 1 each | \$2.95  | \$2.95  |
| <b>B10 · 32 x 7 mm wheel pair, white</b><br><a href="#">Pololu 1088</a><br>Bought-in silicone tyres and 3 mm D-shaft hubs replace printed wheels.                                                                     | 1 pair | \$4.45  | \$4.45  |
| <b>B11 · Forward ToF range carrier VL53L1X</b><br><a href="#">Pololu 3415</a><br>Dedicated forward view. Nominal full FoV 27 degrees; maximum 4 m only under suitable conditions.                                     | 1 each | \$22.95 | \$22.95 |
| <b>B12 · Downward cliff ToF carrier VL53L4CD</b><br><a href="#">Pololu 3692</a><br>Left and right front sensors, 45 degrees below horizontal. Typical FoV 18 degrees. Performance and stopping distance unvalidated.  | 2 each | \$13.95 | \$27.90 |

## Separate views for obstacles and floor

A forward-facing VL53L1X observes obstacles. Two VL53L4CD boards are tilted 45 degrees below horizontal at the left/right front corners. The short-range part is suited to the near-floor geometry; using one tilted sensor for both jobs leaves ambiguous floor-versus-object readings.

## Mechanical references

The official motor archive uses one exterior model for the LP/MP/HP precious-metal brush variants; the 100:1 gear ratio is selected in the BOM, not represented by internal gear teeth. Wheel and caster are official supplier solids. Lead times and measured part tolerances remain release holds.

# Base electronics hardware

Supplier links are clickable. Prices are per stated purchase unit, not per model instance.

| Component / source                                                                                                                                                                                                                                                                                                                                                                     | Qty    | Each    | Total   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|---------|---------|
| <b>B03 · XIAO ESP32-S3 Plus</b><br><a href="#">Seeed Studio 102010671</a><br>8 MB PSRAM / 16 MB flash. Extra GPIO includes underside pads; a carrier or fine soldering is needed. Antenna and USB access still require checking.                                                                                                                                                       | 1 each | \$7.99  | \$7.99  |
| <b>B04 · DRV8833 dual motor driver carrier</b><br><a href="#">Pololu 2130</a><br>2.7-10.8 V input; 1.2 A continuous/channel on carrier, 2 A peak. Configure current limiting after motor tests; not a stall-permission rating. Includes components but no fitted headers.                                                                                                              | 1 each | \$10.95 | \$10.95 |
| <b>B05 · LSM6DS3TR-C 6-axis IMU breakout</b><br><a href="#">Adafruit 4503</a><br>I2C orientation / motion sensing; no magnetometer. Mount rigidly to base. Connector access is additional to board body.                                                                                                                                                                               | 1 each | \$9.95  | \$9.95  |
| <b>B06 · Protected 1S 3.7 V 1200 mAh LiPo</b><br><a href="#">Adafruit 258</a><br>Packaging candidate, not a validated power source for all actuators together. Vendor lead rating 2 A; cell sheet 2.4 A continuous. Reserve soft padding and swelling room; do not clamp pouch tightly. Official CAD exceeds published pouch dimensions; allow larger model and verify delivered cell. | 1 each | \$9.95  | \$9.95  |
| <b>B07 · USB-C single-cell LiPo charger</b><br><a href="#">Adafruit 4410</a><br>Set 500 mA charge current. Prototype charges with robot disconnected / OFF. This board is not a load-sharing power-path module. Do not parallel with XIAO charger.                                                                                                                                     | 1 each | \$5.95  | \$5.95  |
| <b>B08 · 5 V boost regulator U3V40F5</b><br><a href="#">Pololu 4012</a><br>Candidate servo / logic 5 V rail. Input current capability is not 5 V output current. Battery, connectors, heat and short-circuit protection remain to be designed.                                                                                                                                         | 1 each | \$9.95  | \$9.95  |
| <b>B09 · MAX98357A I2S mono amplifier</b><br><a href="#">Adafruit 3006</a><br>Height reserve includes terminal-block allowance. Limit gain / signal to protect the 1 W speaker. Optional header height not included.                                                                                                                                                                   | 1 each | \$5.95  | \$5.95  |

# Upper body hardware

Supplier links are clickable. Prices are per stated purchase unit, not per model instance.

| Component / source                                                                                                                                                                                                                               | Qty    | Each   | Total   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------|---------|
| <b>U04 · Mini oval speaker, 8 ohm / 1 W</b><br><a href="#">Adafruit 3923</a><br>Official Adafruit STEP includes diaphragm and terminal stubs. Acoustic cavity and wire connection are future upper-body work.                                    | 1 each | \$1.95 | \$1.95  |
| <b>U01 · 1.3-inch 240 x 240 IPS LCD / ST7789</b><br><a href="#">Waveshare 15867</a><br>Separate display preserves common base controller. Height is a CAD allowance; verify connector projection before final shell design.                      | 1 each | \$9.49 | \$9.49  |
| <b>U02 · SG92R positional micro servo</b><br><a href="#">TowerPro / Adafruit 169</a><br>Two arm actuators, not wheel drives. Servo samples vary: another vendor sheet gives 23 x 12.2 x 27. Measure ears, shaft and horn before freezing mounts. | 2 each | \$5.95 | \$11.90 |
| <b>U03 · SPH0645LM4H I2S MEMS microphone</b><br><a href="#">Adafruit 3421</a><br>Provide an acoustic port facing outward. Check ESP32 I2S timing and microphone/amplifier coexistence in firmware.                                               | 1 each | \$6.95 | \$6.95  |

## CAD confidence

Official supplier STEP is used for motors, wheels, caster, battery, driver, boost, charger, amplifier, all three range carriers and speaker. The ToF carriers share one official PCB model; the sensor package appearance is generic. XIAO, IMU, servos, display and microphone contain reconstructed geometry and remain fit holds.

## Source records

Component download URLs and SHA-256 checksums accompany the CAD source. Adafruit CAD is supplied under MIT; its IMU board source has an LGPL license. Pololu public reference models retain their supplier notices. Reconstructed geometry is clearly separated in the manifest.

## Sensor architecture

Front sensors observe two limited floor regions, not a continuous perimeter. Reversing and turning near a drop are not protected by this front-only arrangement. Stop on invalid/stale readings. A rear cliff channel or motion restrictions will be needed before untethered tabletop use.