

# MechBase Starter Kit — Project 1: Rolling Chassis

**Age:** 7+ | **Concept:** Basic circuit, motor control, cause & effect

**Before you build:** Download [BrickLink Studio](#) (free, Windows/Mac). Build the chassis virtually, then print professional step-by-step instructions with photos. Studio uses the LDraw part database — every LEGO-compatible part is available.

## BrickLink Studio — Quick Start

- **Download:** [bricklink.com/v3/studio/download.page](https://bricklink.com/v3/studio/download.page) (free)
- **Platform:** Windows 10+ or macOS 12+
- **Part library:** 100% of LEGO parts + compatible alternatives
- **Instructions:** Build → File → Create Instructions → Auto-generates step-by-step with photos
- **Export:** PDF, PNG, or interactive HTML

**Workflow:** Build the chassis in Studio using the parts list below → Generate instructions → Print for the kid. The software handles part positioning, collision detection, and photo rendering. Way better than hand-coding SVGs.

## Verified Parts List

Part numbers verified on BrickLink. Search these exact numbers.

| Part # | Qty | Name                            | Use                         |
|--------|-----|---------------------------------|-----------------------------|
| 3811   | 1   | Baseplate 32 × 32               | Chassis foundation          |
| 3701   | 4   | Technic Brick 1 × 4 with Holes  | Axle mounts, beam structure |
| 3894   | 4   | Technic Brick 1 × 6 with Holes  | Longer structural beams     |
| 3895   | 4   | Technic Brick 1 × 8 with Holes  | Frame rails                 |
| 3896   | 4   | Technic Brick 1 × 10 with Holes | Main frame rails            |
| 3704   | 4   | Technic Axle 2L                 | Short connectors            |
| 3705   | 6   | Technic Axle 4L                 | Wheel axles                 |
| 44294  | 2   | Technic Axle 7L                 | Long spans                  |
| 3737   | 2   | Technic Axle 10L                | Drive axles                 |

|       |    |                              |                              |
|-------|----|------------------------------|------------------------------|
| 44260 | 10 | Technic Bushing ½"           | Wheel mounts, friction rings |
| 4256  | 2  | Technic Gear 12 Tooth        | Motor reduction              |
| 4257  | 2  | Technic Gear 20 Tooth        | Speed reduction              |
| 4258  | 2  | Technic Gear 40 Tooth        | Output gearing               |
| 32202 | 2  | Technic Bevel Gear 12 Tooth  | Direction changes            |
| 6259  | 4  | Technic Wheel 1.25"          | Drive wheels                 |
| 6258  | 4  | Technic Rim 1.25"            | Wheel hubs                   |
| 99233 | 8  | Technic Pin 1L with Friction | Beam connectors              |
| 32062 | 6  | Technic Axle 2L Notched      | Secured axle connections     |



## Electronics (Same as Before)

| Item                           | Qty | Notes                            |
|--------------------------------|-----|----------------------------------|
| Raspberry Pi 4 8GB             | 1   | Already owned                    |
| Adafruit Dual Motor Driver HAT | 1   | I2C, powers 2 DC motors + servos |
| TT Gear Motor (90 RPM, 6V)     | 2   | High torque                      |
| SG90 Micro Servo               | 1   | Future projects                  |
| HC-SR04 Ultrasonic             | 1   | Distance sensing                 |
| TCRT5000 IR Sensor             | 2   | Line tracking                    |
| Limit Switch (Micro)           | 2   | Position sensing                 |
| LiPo 7.4V 2200mAh (2S)         | 1   | Motor power                      |
| 2S LiPo Charger (1A)           | 1   | Safe charging                    |
| Breadboard + Jumper Kit        | 1   | Prototyping                      |



## Step-by-Step Build Instructions

### Step 1 — Frame Rails

Attach four **Technic Brick 1×10 with Holes (3896)** to the baseplate in a rectangular frame:

- Two along the long edges (rows 4 and 29)
- Two along the short edges (columns 6 and 27)

This creates your chassis perimeter. The holes in the beams accept axles and pins.

### Step 2 — Axle Supports

Attach **Technic Brick 1×4 with Holes (3701)** perpendicular to the frame at each corner (rows 8 and 25, columns 10 and 23).

These create the axle mount points. The beams slot into the frame holes using **Technic Pins with Friction (99233)**.

### Step 3 — Install Axles

Slide **Technic Axle 10L (3737)** through each pair of axle support beams (left side and right side).

- Axle goes through: Beam hole → Axle 10L → Beam hole
- Secure with **Axle 2L Notched (32062)** on each end to prevent wobble

### Step 4 — Wheels

On each axle end: **Bushing ½" (44260)** → **Rim 1.25" (6258)** → **Wheel 1.25" (6259)**

The bushing provides friction so the wheel stays on the axle during operation.

### Step 5 — Motor Mounts

Mount each **TT Gear Motor** to the rear axle area using:

- Beam 1×6 with Holes (3894) as motor bracket
- Motor shaft aligns with **Gear 12 Tooth (4256)**
- 12T gear meshes with **Gear 40 Tooth (4258)** on the drive axle

This gives ~3:1 speed reduction — slower but more torque for the chassis.

### Step 6 — Electronics

- Mount Pi 4 on top of the chassis (use rubber feet or Technic brackets)
- Plug Adafruit HAT directly onto Pi GPIO pins
- Connect Motor 1 → HAT M1, Motor 2 → HAT M2
- Connect LiPo to HAT VIN/GND terminals



## Code (Copy to Pi)

See the separate software document for the full Python code. This is the basic drive logic:

```
# Forward
motor_left.throttle = 0.5
motor_right.throttle = 0.5

# Reverse
motor_left.throttle = -0.5
motor_right.throttle = -0.5

# Turn left
motor_left.throttle = -0.3
motor_right.throttle = 0.5
```



## Project 1 Challenges

| # | Challenge                                    | Concept               |
|---|----------------------------------------------|-----------------------|
| 1 | Drive forward 1 meter, then stop             | Motor control, timing |
| 2 | Drive forward, reverse, turn — make a square | Sequencing logic      |
| 3 | Use limit switch to stop at a wall           | Sensor feedback       |
| 4 | Obstacle avoidance (ultrasonic)              | IF/THEN logic         |