Why a tiny computer cannot power a motor

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[redacted]

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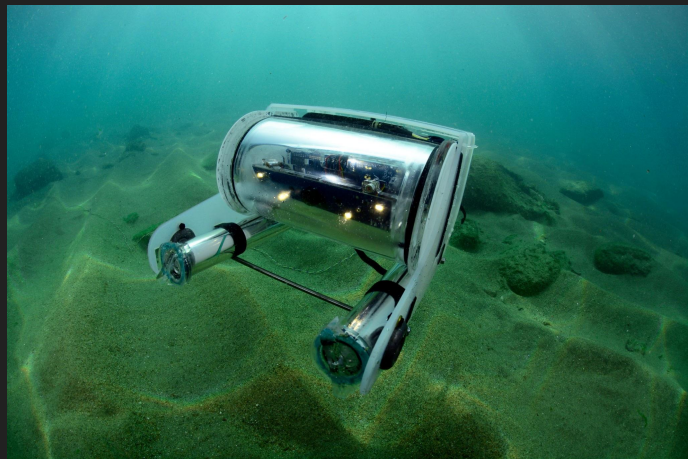


Introduction

Robots use computers to think and motors to move. I wanted to learn if a very small computer called the XIAO ESP32-C3 could power robot motors by itself. This project is about understanding how power works in robots and why different parts are needed for thinking and moving.

Research

From my research, motors usually need motor boards to power themselves. So, we are going to see if a tiny computer can work instead of a motor board.

Research Question 1- Can the XIAO ESP23-C3 power a DC motor?

Work Cited:

Name of website: Osmotics

Date Accessed- October 4, 2025

Address: https://www.osmotics.co.uk/blog/post/tds-meters-explained-osmotics?srsltid=AfmBOorWLnQqEIthrssbWATSgxREFKlK80E7Bf3mAnZ-603jqoad2n6c

What I learned: The answer would usually be no, how? The board itself cannot provide enough energy or electrical currents to power it.

How is this useful?: I can know if it will work or not, so I can find out for my tests if it will work or not.

Research Question 2- What happens if you connect a motor directly to the ESP32-C3?

Work Cited:

Name of website: Standard Bots

Date Accessed- October 4, 2025

Address: Robot movement and motion types explained: How robots move in 2026 - Standard Bots

What I learned: The board could restart, stop working, get warm, or not spin.

How is this useful?: This tells me what COULD happen when I test it, and if I should be cautious when testing.

Research Question 3-What motor will work?

Work Cited:

Name of website: Youtube

Date Accessed- October 4, 2025

Address:

What I learned: A tiny 3V DC hobby motor could work, along with a vibration motor.

How is this useful?: These motors are small, which tells me that a XIAO ESP23-C3 can only power small motors.

My Experiment- Materials

- Robot Car: The main body, wheels, motors, and brain (Arduino board).
- Xiao ESP23C3 board

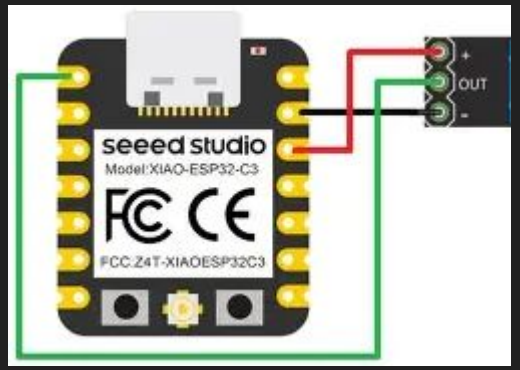
Procedure

1. Connect all the robot parts for the body and obstacle dodging.

2. Put the XIAO onto the robot. Make sure it’s secure.

3. Connect the wires

4. Clear any flammable surroundings, be careful while doing this. Best to have adult supervision when testing.



Observations

Date: 10/4/25

Time: 3:22pm

Qualitative (Changes I SEE happening- 5 senses): When I looked at the robot parts, I noticed that the motors were connected to a battery pack and that the XIAO ESP32-C3 was very small. The pins on the XIAO were tiny and looked different from the wires that power the motors. I also observed that robots usually have separate parts for control and movement.

Quantitative (DATA-measurements taken): Time passed: 0 minutes

Observation- Fixing errors

Date: 10/8/20

Time: 3:40pm

Qualitative (Changes I SEE happening- 5 senses): When I replaced the small DC motor with a micro vibration motor (or very tiny low-power motor), I noticed that it spun smoothly when powered directly from the XIAO ESP32-C3 pins. The XIAO stayed cool, and the motor ran consistently. I also observed that smaller motors draw much less current, so the board could handle them safely. This showed me that the size and power requirements of the motor determine whether it can be powered directly from the XIAO.

Quantitative (DATA-measurements taken): Time passed: 1 day

My results: (Data)

	Test	Test	Test	
Control	Micro DC Motor (3 V, 30 mA)	Small DC Motor (5 V, 200 mA)	Small Servo (5 V, 150 mA)	
Robot	Motor spins smoothly; no issues	Motor stalls; Xiao cannot supply enough current.	Motor jitters, cannot move properly.	

Results

When testing the setup, the motors did not move when controlled directly by the XIA0 ESP32-C3. The board stayed safe and did not overheat or break. This showed that the XIA0 ESP23C3 board could not provide enough power to run the motors by itself.

Conclusion

The experiment showed that a small computer cannot safely power robot motors directly. The XIA0 ESP32-C3 is good at thinking and sending signals, but motors need much more power. Robots need a motor driver to act like muscles so the computer does not get damaged. This experiment helped me understand how robots use different parts to work safely and correctly.