Square Lab!

Spring 2026

Announcement

- $10 Lab Fee
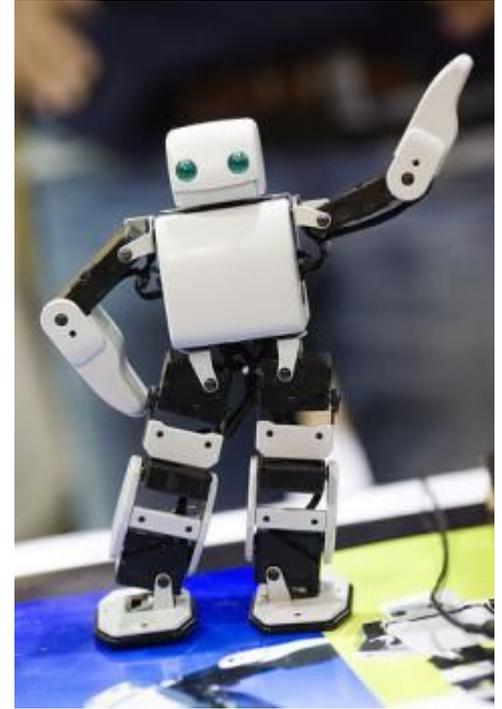 - By Cash. Please bring small denominations

Outline

- What is a robot
- Tour of our robot
- Differential steering
- Programming in the Arduino IDE
- Square Lab Challenge

But before all of that...

what actually **is** this lab?

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Your Goal:

- In teams of two or three, make your robot move in a square!
  - The squares do not have to be super precise; as long as the robot moves in a relatively squareish shape we will be happy.

- Then: make up a cool dance for your robot to a song (robot-generated or premade) of your choice!

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What's Our Robot?

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Romi!

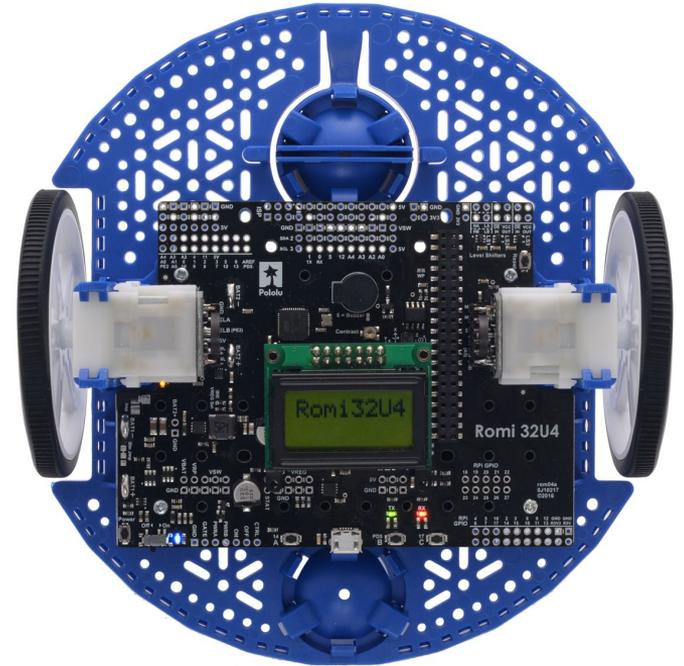Photo courtesy of Pololu.com

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Romi 32U4 Control Board

- The board controls your robot, allowing you to communicate with and control it.

- This board contains:
  - Microcontroller
  - Motor Controller
  - Many different input and output methods

Photo courtesy of Pololu.com

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ATmega32U4 AVR MicroController

- Allows your robot to "think"

- *Cool* Stats
  - 16 MHz processor
  - 2560 bytes of RAM
  - 32 KB of program memory

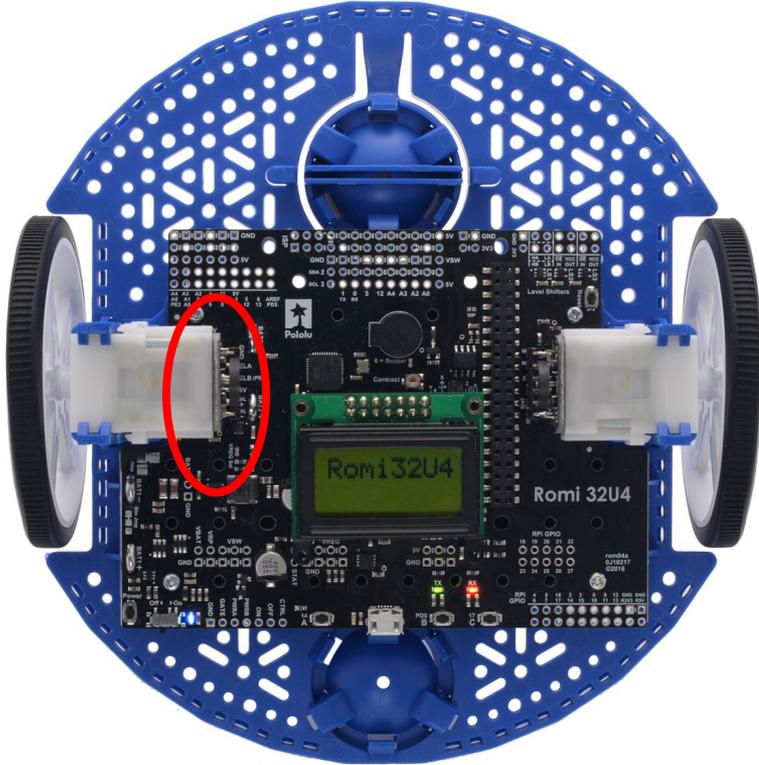Photo courtesy of Pololu.com

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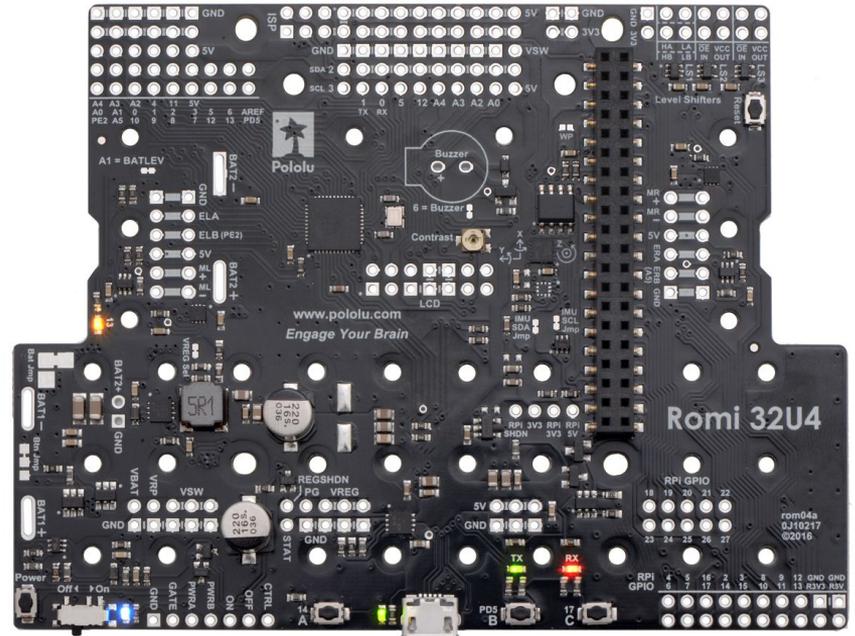
Candy Question!

- Approximately how many times more memory(RAM) does the newest Macbook Pro have versus our robot?

50, 000, 000 times! (for 128GB)

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Motor Controller

- Decides how fast and in which direction to run the motors
  - Controlled via setting "Motor Speed"
  - Integer between -200 to 200

- Interfaces with encoders to allow more precise motor distance control

Photo courtesy of Pololu.com

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Other Input and Output

- Input Methods:
  - **Sensors**: accelerometer and gyroscope, and [more](#).
  - **Code**: MicroUSB input
  - **Human**: Three push-buttons

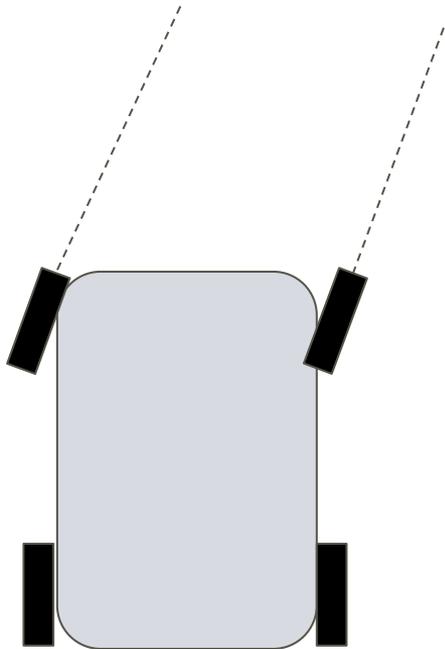- Output Methods:
  - 3 LEDs
  - LCD Screen

Photo courtesy of Pololu.com
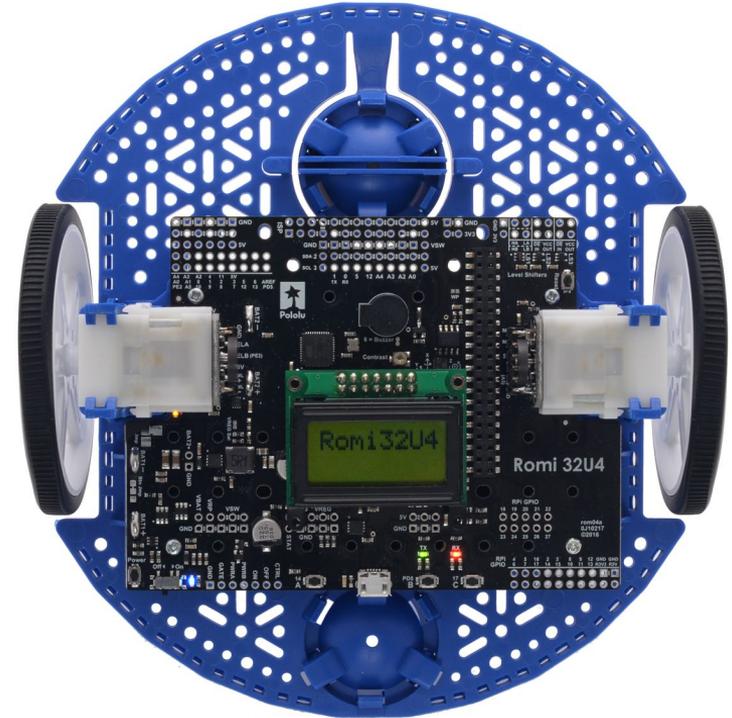
Making Robots Move

There are lots of ways that robots can move, but ours use *differential steering*

C.H.I.M.P.
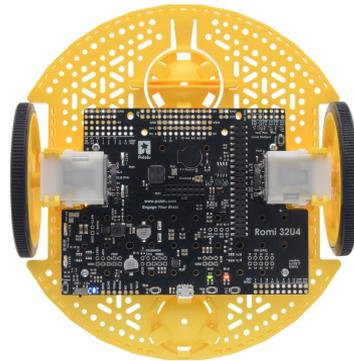
Differential Steering

"Regular" Steering

Differential Steering

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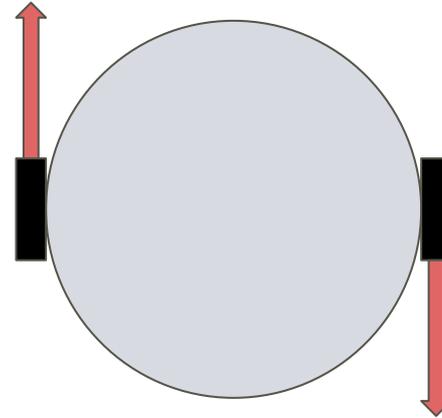
Candy Time!

What is the advantage of differential steering?

You can turn in place! This is perfect for our small, nimble, two-wheeled robot.
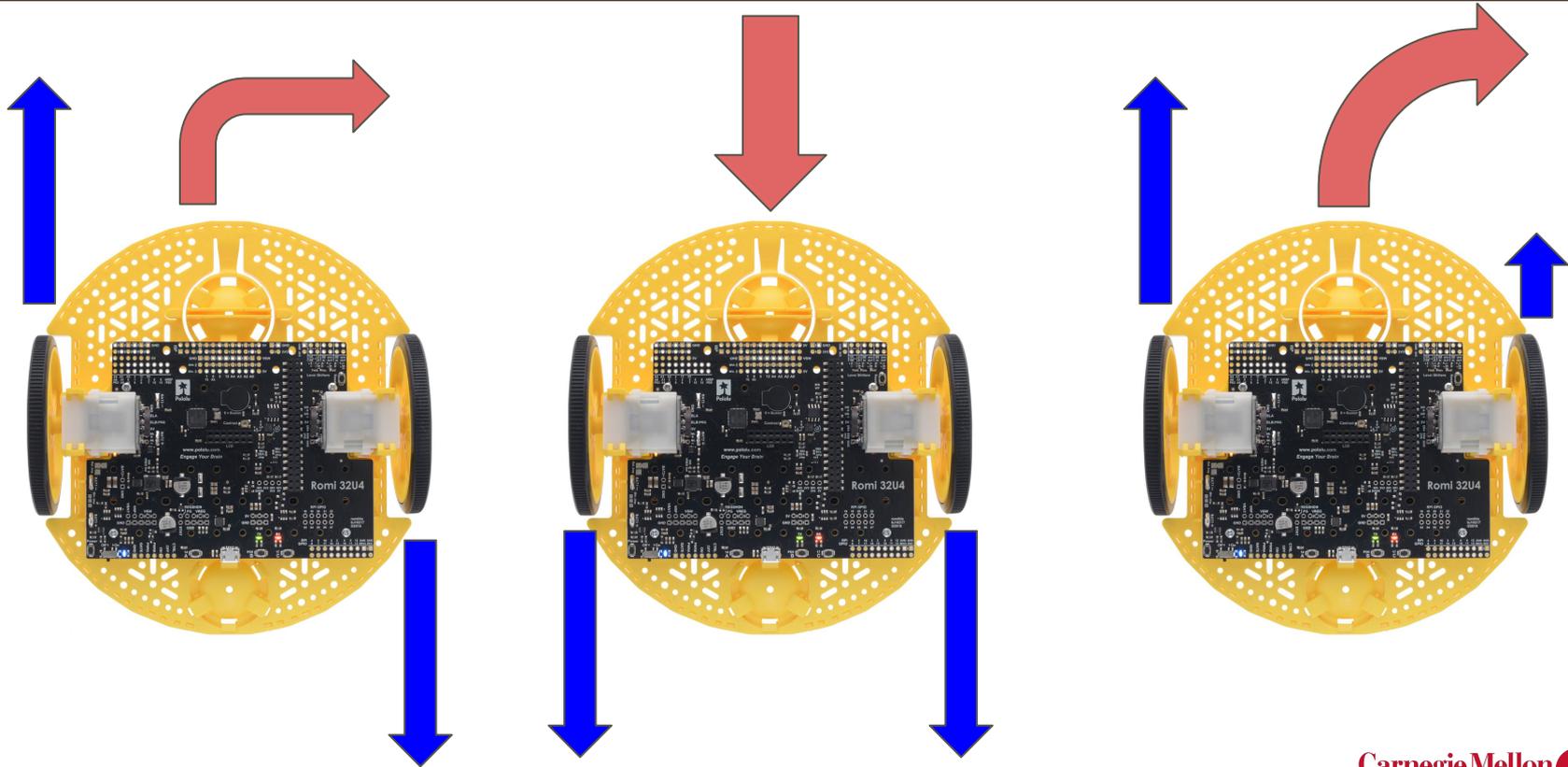
Why don't cars have differential steering??

You need more than one motor to move each set of wheels independently, which is impractical. Furthermore, the wheels would drag along the ground when turning in place.

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Moving your Romi
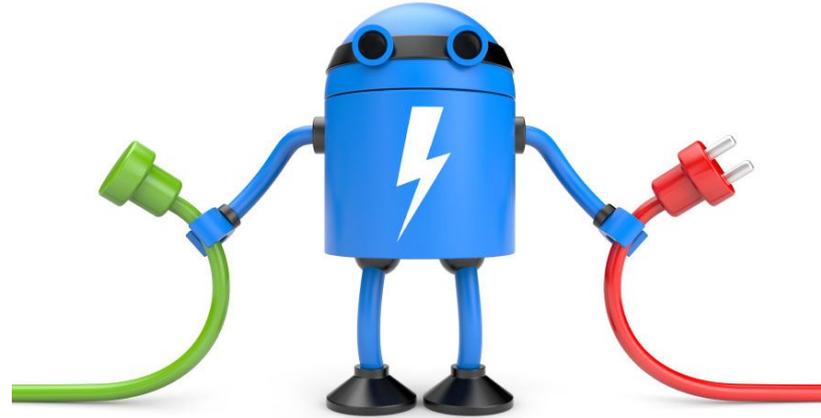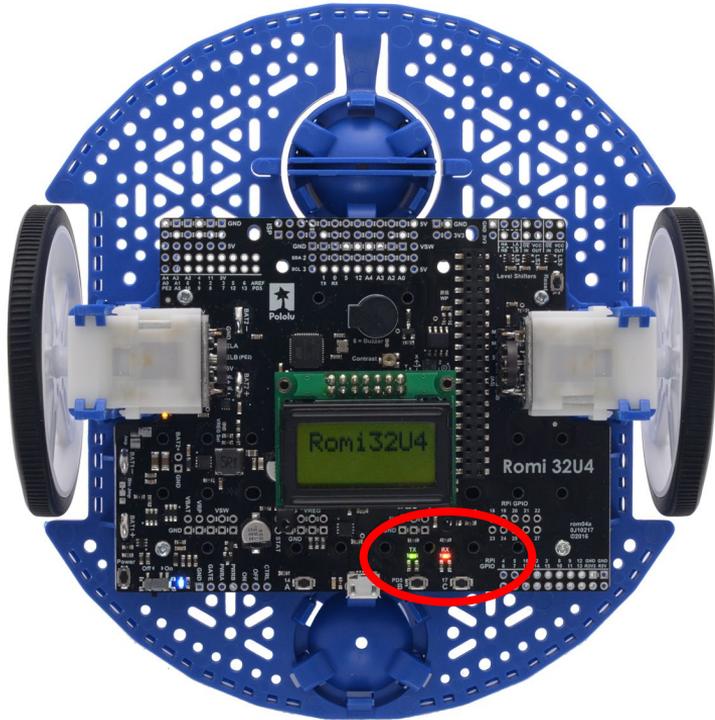
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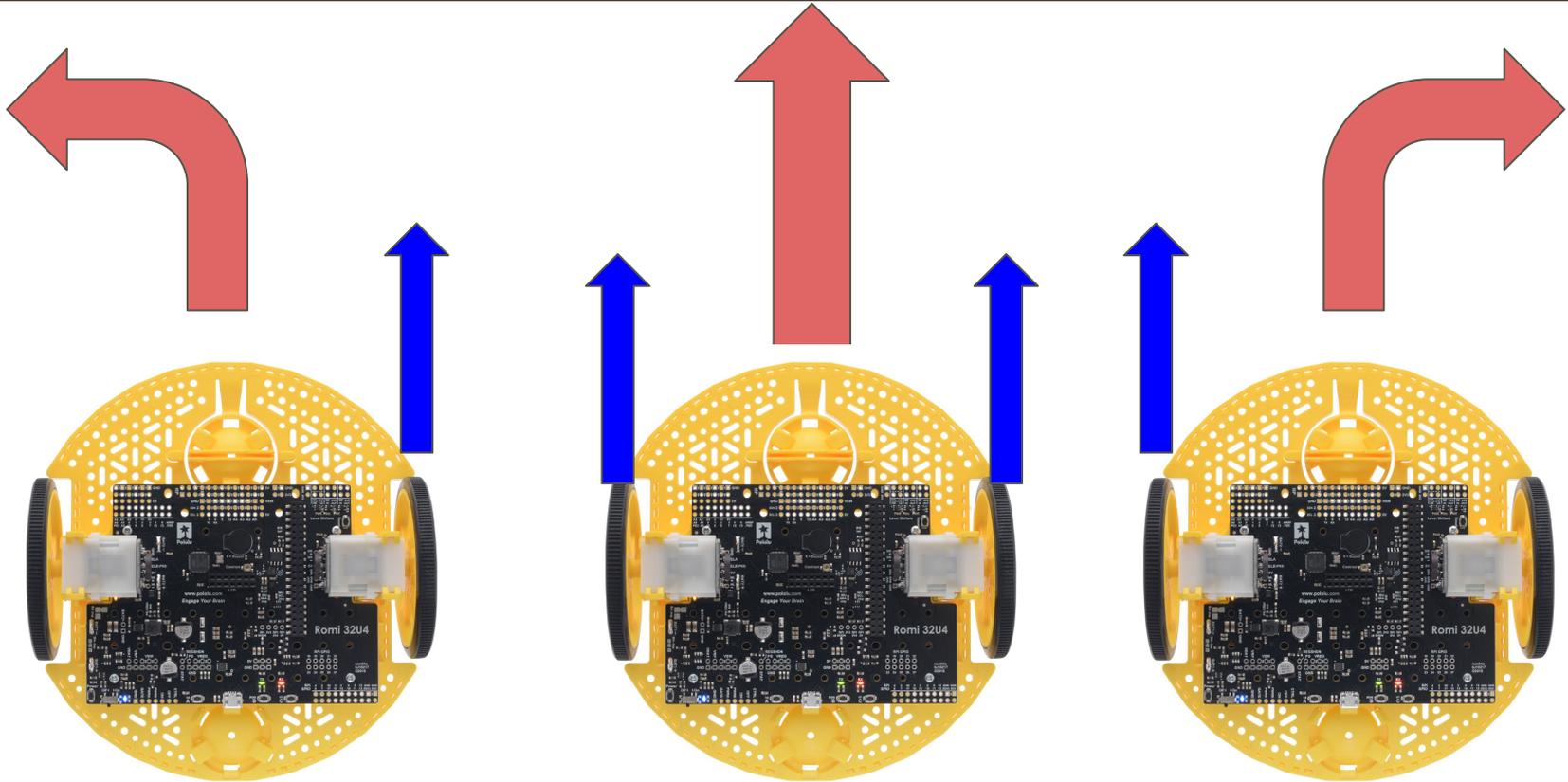
Candy Time!

Try it Out!

- Get in groups of 2 - 3

- Setup Arduino According to Slides

- Schedule -> Week 2 -> Handouts

- Open in Arduino

- Plug in your robot (just use your micro-USB cable!)

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Tips and Tricks

- The circled lights should flash when code is uploading.

- Make sure you have chosen your port before uploading!

- It may take a few times clicking the upload icon for it to go through.

- Run individual parts of your code (say, turning) rather than the entirety of your program all at once.

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Bad User Interfaces...
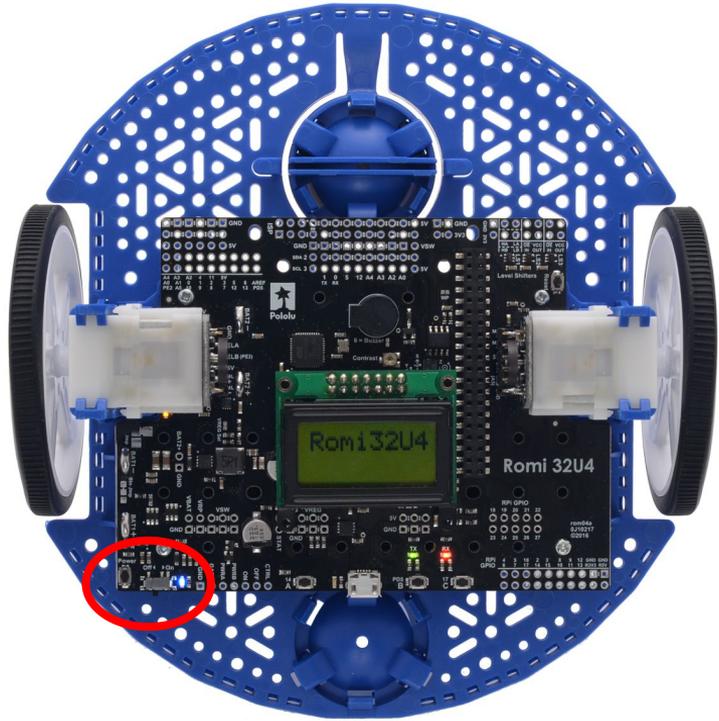
- The switch connects/disconnects the batteries from the power system
- If the switch is off, you can turn on the robot by pressing the power button
- The robot will appear to be "on" when plugged in to the computer, but the motors likely won't be powered

ALERT!

- **Do not unplug your robot from the computer while your code is uploading!** This may cause your robot to "brick," i.e. your robot dies!
- If your robot gets stuck uploading, please call us over so we can help you!

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