Exploring the Inner Workings of Ozobot Bit

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Introduction

We chose to disassemble the Ozobot (later, Ozobot Bit). First released in 2014, Ozobot is an introductory coding robot that can be programmed to move using its unique color language.

For this project, we considered a VHS camcorder, walkie-talkie, and the Ozobot. The camcorder, with multiple unique components, was very interesting. We, however, settled on the Ozobot because it brought back happy memories from elementary school. Also, we were fascinated by the complexity and the simplicity of its design and function. Ultimately, the e-mail from the Ozobot support team solidified our decision. When we reached out to them for some information, they wrote:

Ozobot Support Team <support@ozobot.com> Tue, Jan 2, 7:58 AM (1 day ago)
to me

Thank you for contacting Ozobot!

We appreciate your interest in Ozobot Bit. Unfortunately, we do not offer information on Ozobot parts.

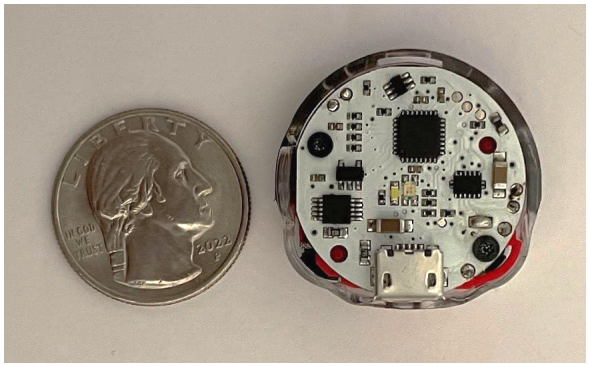
-Ozobot Customer Support Team

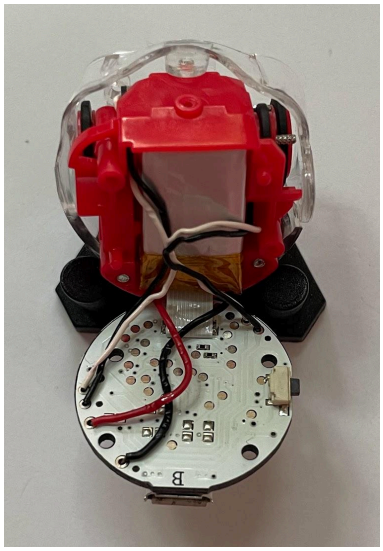
So, we accepted the challenge.

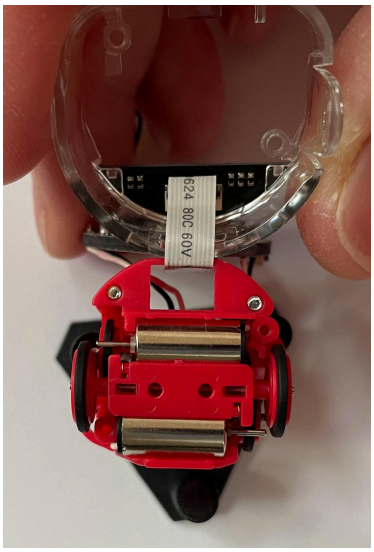
Disassembly

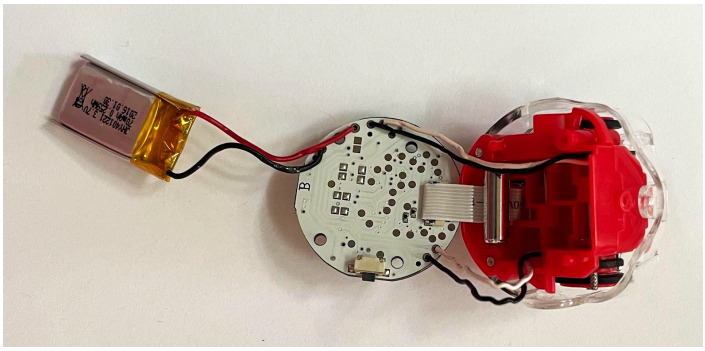
Screwdrivers (T5 and 3x30mm flathead)

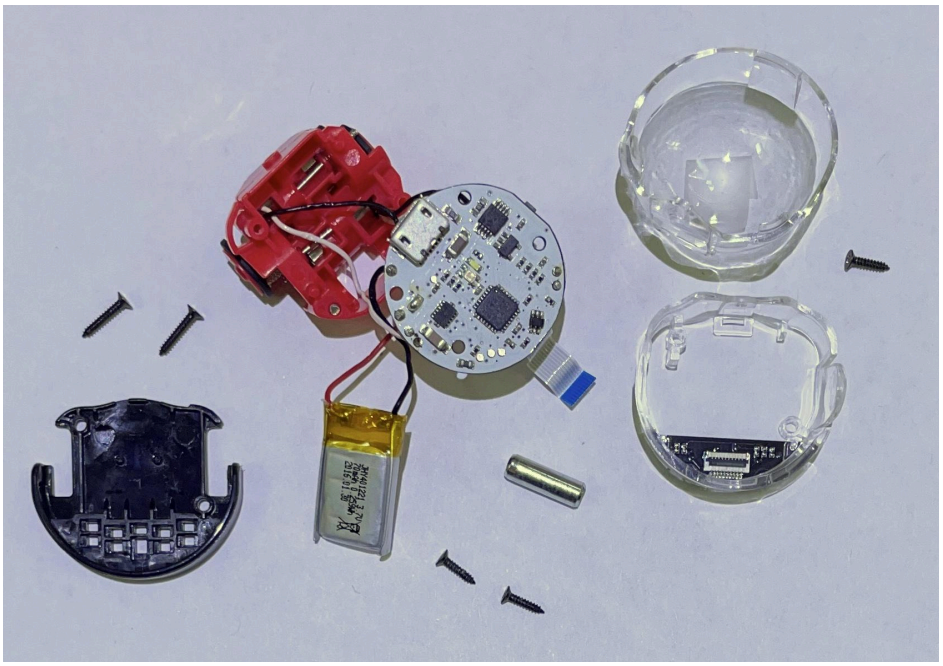
Zeiss Stemi 508 microscope equipped with Axiocam 105 camera (0.63 or 5 NA) for component photos.







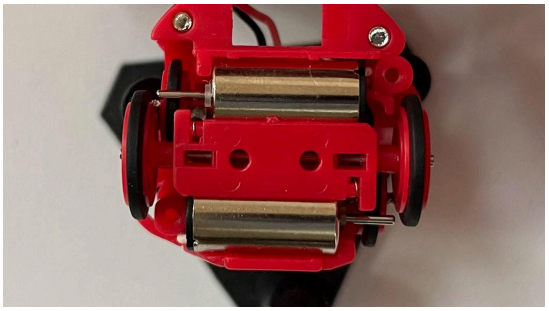




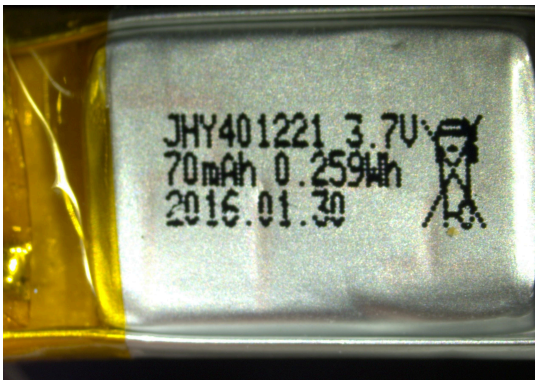
*The battery wire was not cut because max voltage output of 3.7V is considered safe to handle.

Component Analysis

Drivetrain

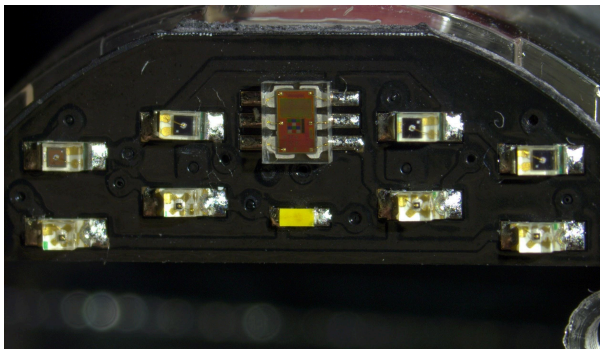
	Coreless motor Two small electric motors, each powering the wheel on one side.
	Drivetrain The Ozobot utilizes a friction drivetrain to prevent force being translated into the motor when there is pushback against the wheels. A spring connects a wheel to the axle to keep the wheels in contact with each other. The staggered alignment of the wheels allows both motors to be positioned in the small frame and still have the wheels across from each other.

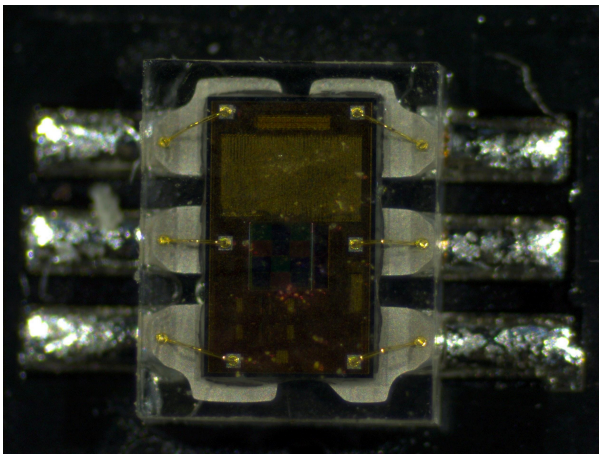
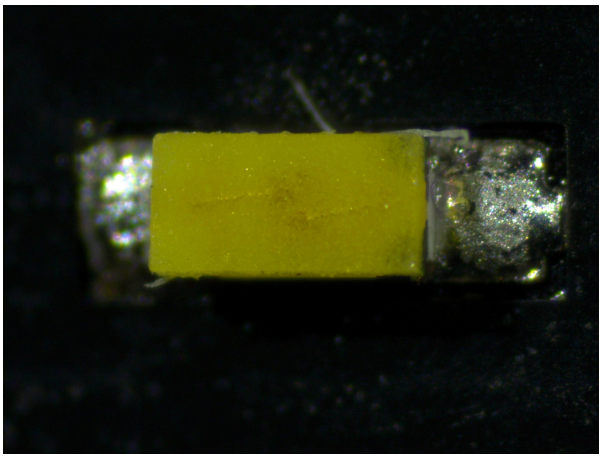
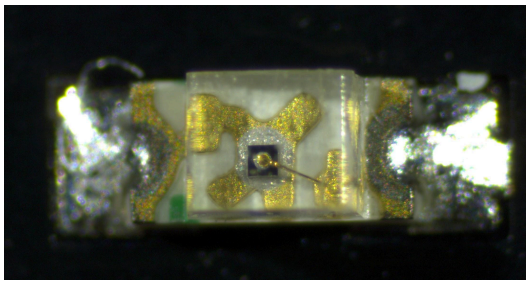
Battery

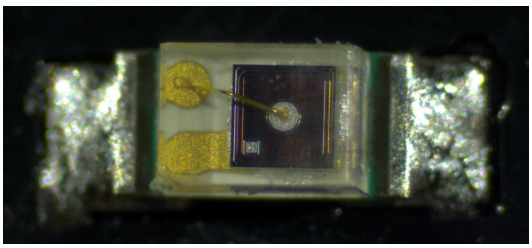
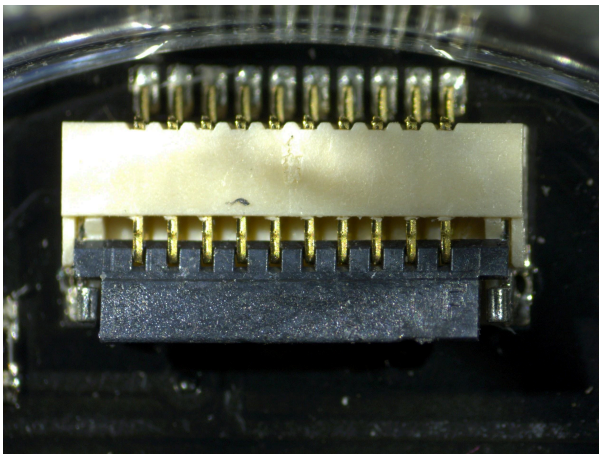
	Lithium polymer battery Max output of 3.7V allows ~60 minutes of use per charge. It is flat to fit into the compact space.

Tracking sensor system

Allows Ozobot to “see” colors and lines.

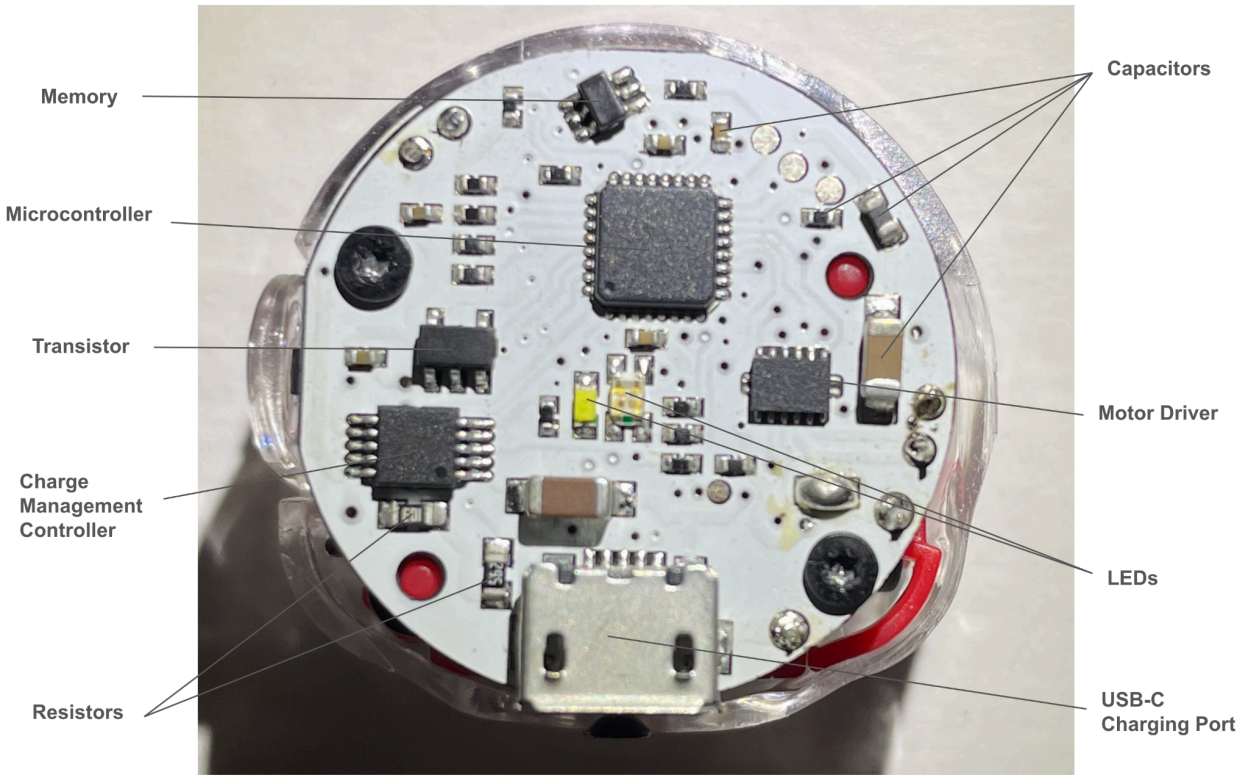


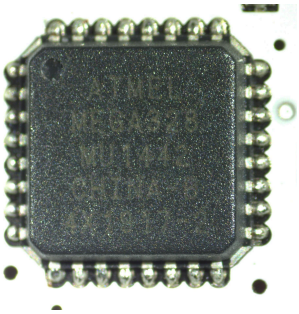
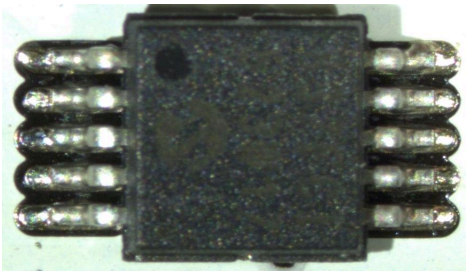
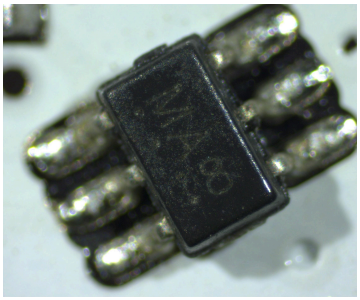
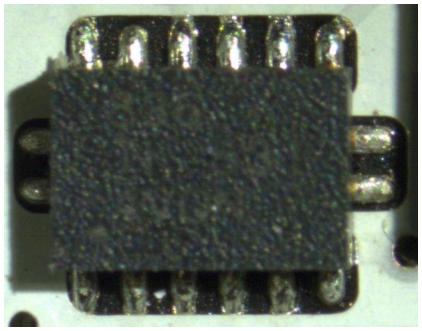
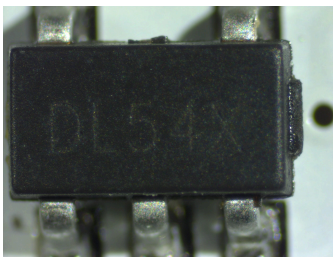
	RGB Sensor Detects the color of the line.
	LED with phosphor film Phosphor material absorbs energy from the LED light to transmit “white” light.
	Single-color LED Illuminates the area under the Ozobot.

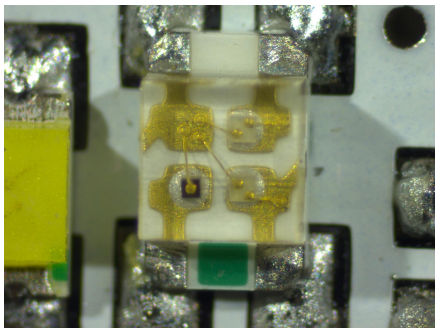
	Photosensor Detects light, which in Ozobot is the presence/absence of the line.
	Senor board port Connects the wire providing power and information to/from the main circuit board.

Circuit Board

Contains a variety of interconnected electronic components, each performing specific functions.



	<u>Microcontroller (ATMEGA328P-MU)</u> Processes information.
	<u>Charge Management Controller</u> Optimizes battery charging time and regulates voltage output to keep below battery's max voltage output.
	<u>Memory</u> Stores information that components on the circuit board can access.
	<u>Motor Driver</u> Interface between the microcontroller and motor.
	<u>Transistor</u> Amplifies or switches electrical signals.

	<u>Resistor</u> Limits the flow of electricity through a circuit. Printed numbers show the resistance value (103 = 10000Ω).
	<u>Ceramic Capacitor</u> Stores and releases electric charge quickly.
	<u>Multicolor LED</u> Displays the color of the line “read” by Ozobot.

Conclusion

Through this project, we came to appreciate the enormous design challenges posed by size constraint. Now, we are curious how the Ozobot software controls the components we identified. Last but not least, it was exciting to visit a university laboratory to use a microscope to take pictures.

Report total word count: 491

Citations

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Professor Arthur Lander at University of California, Irvine for the use of the microscope.

Personal communication with Rany Tith, a graduate student at University of California, Irvine.