

OPTIBOT™

Innovation Exploration Kit™
I Can Invent® Series



Get ready to navigate the future with your very own Optibots!

Design themed courses with obstacles that will put your robots to the test.



Camp Invention®



OPTIBOT™

.....||| Use this password to access
your Optibot experience: **SENSOR**

Read prior to using the product.

SAFETY AND HYGIENE



WARNING: Choking hazard—small parts. Not for children under 3 years.

- All activities require adult supervision.
- Ages 5+.
- Read and follow all instructions.
- For safety and hygiene purposes, please be sure all children wash their hands after each activity.
- Demonstrate how to properly hold and use scissors. Do not run with scissors.
- Do not allow children to put materials in or near anyone's eyes, mouths, and ears.
- Do not play with or place plastic bags near the face or mouth.
- Ventilate the room when using markers.
- Batteries are only to be used under adult supervision.
- Insert batteries with the correct polarity.
- Remove the batteries during long periods of non-use. Always remove exhausted batteries from the robot. Battery leakage and corrosion can cause damage.
- Never short-circuit the battery terminals.
- Do not mix old and new batteries. Do not mix different types of batteries: alkaline, standard (carbon-zinc), or rechargeable (nickel cadmium).
- Remove all batteries prior to taking apart a robot.
- Dispose of batteries safely. Do not dispose of batteries in fire. The batteries may explode or leak.
- Button and coin batteries can be harmful if swallowed. Please take precautions to make sure they are not placed near the children's mouths.
- Do not allow button or coin batteries to touch when not in use.



MATERIALS

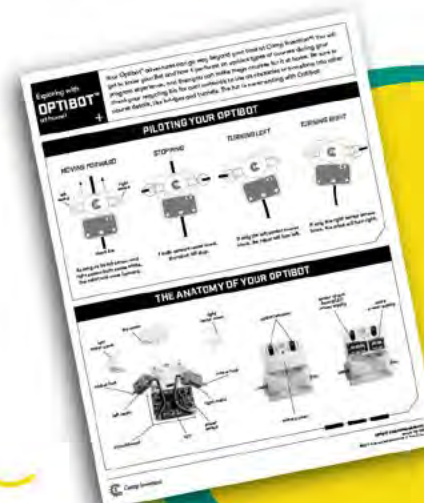
- Adhesive gems
- Black permanent marker
- Clay
- Colored permanent markers
- Copy paper
- Exploring With Optibot sheet
- Finger flashlights
- Inventor Log
- Masking tape
- Ocean stickers
- Optibots
- Paper cups
- Pencil
- Spec sheets

INSTRUCTIONS



MUSIC, VIDEOS, and POSTERS can be found online at invent.org/i-can-invent/Optibot

*Is creativity one of your superpowers?
Activate it by coloring in your cardboard box!*



MEET A HALL OF FAMER



1. Discover the power of sensors, vehicles, and robots with National Inventors Hall of Fame® (NIHF) Inductee Fran Ligler (inventor of Portable Optical Biosensors) by watching the "Ligler" video.



2. Play "Background Music 1."



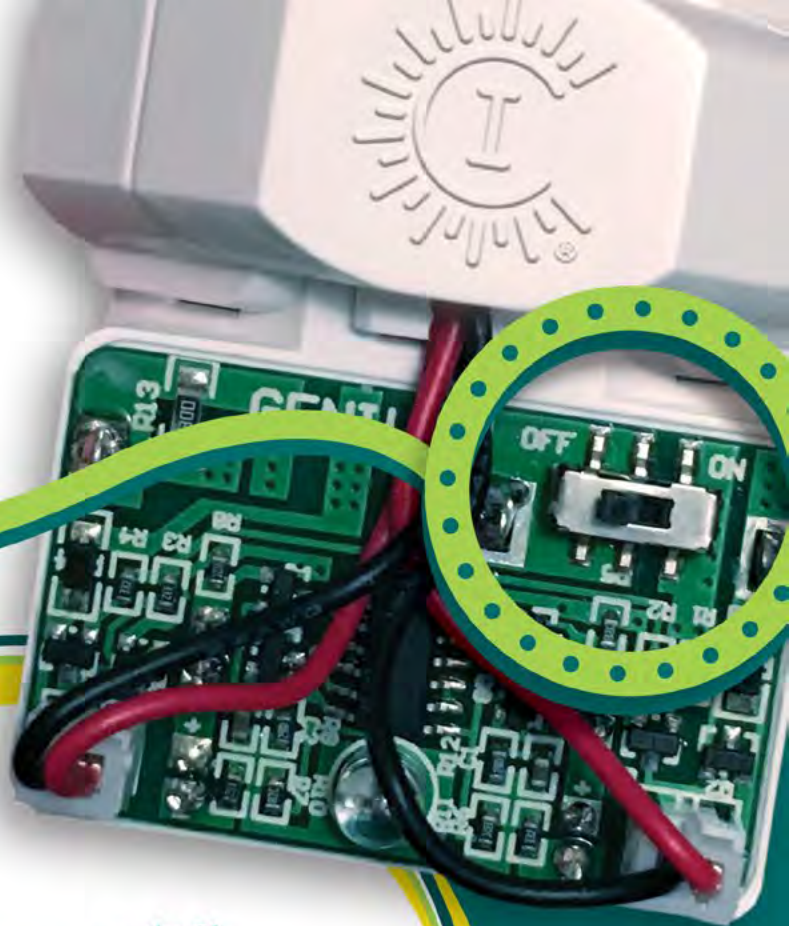
3. Sketch a futuristic vehicle in your Inventor Log and include sensors in your design. Check out the Future Vehicles poster for inspiration.

Learn more about Ligler here:
invent.org/inductees/frances-ligler



GET YOUR OPTIBOTS READY ●●●

1. Pull out the tabs on the bottom of your Bots to activate the batteries.
2. Slide the switch to turn on each Optibot—you'll know they're powered up when the lights blink!





Is your Bot having some trouble? Try these tips:



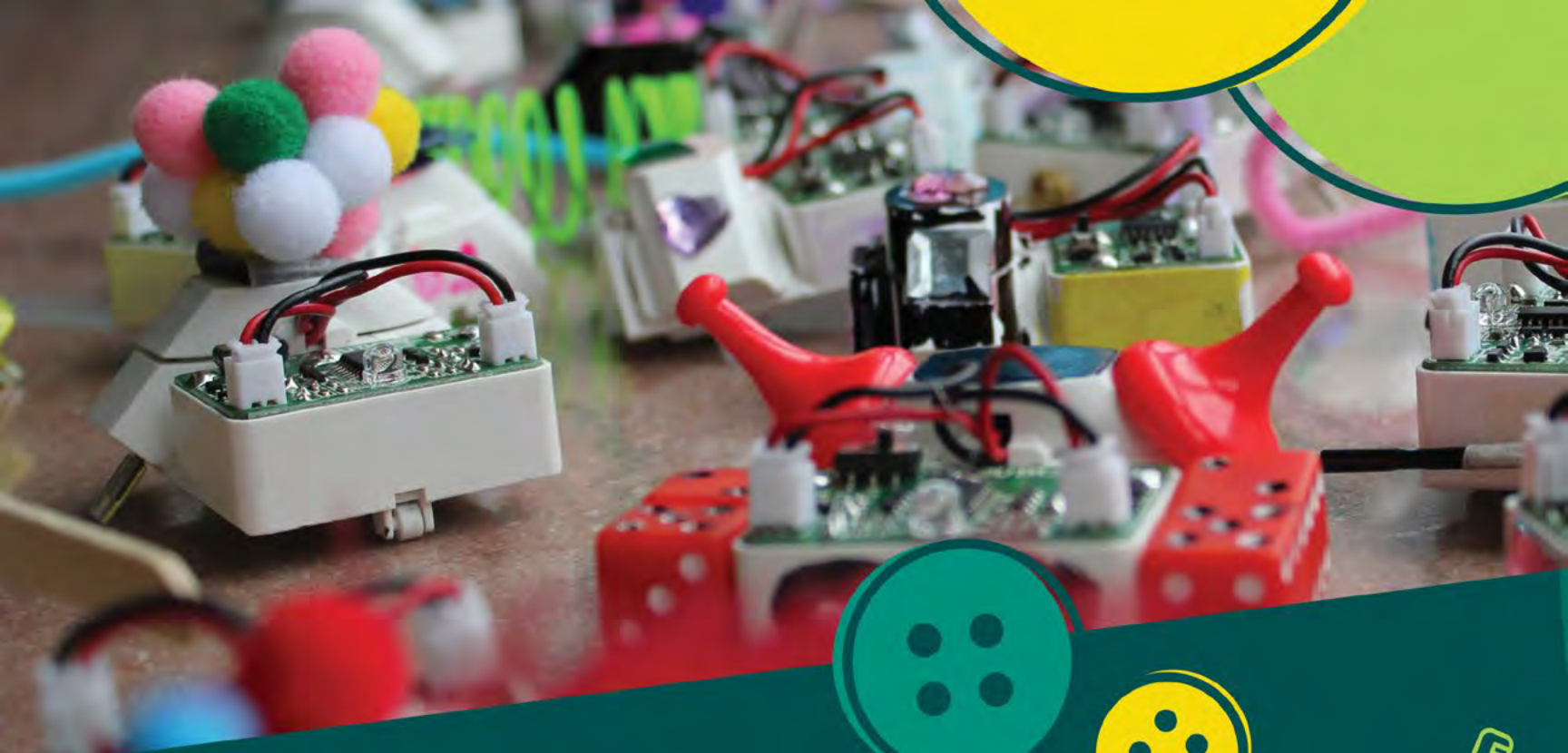
- Gently turn your Bot off and on once or twice.
- Make sure the motor can spin freely. (The plastic casing on the axles should be pulled away from the Bot's body.)
- Ensure the sensors on the bottom of the Bot are clear.

TEST YOUR BOTS

1. Take the black permanent marker and draw a short, straight line in your Inventor Log.
2. Put your Optibot on the line and watch it follow along!
3. Now draw a curved arc. Make sure it's thick enough for the Bot to follow it.
4. Test your Bot on the arc.
5. Grab a new piece of paper and draw a large oval. Just don't get too close to the edge! (Leave about half the width of the Bot around the edge of your track.)
6. Start playing "Background Music 2." 
7. Test one of your Optibots on the oval, then add another and watch them both loop the course!
8. Sketch some loops, arcs, s-shapes, and figure 8s in your Inventor Log. You can check out the Getting to Know Optibot sheet for some examples.
9. Grab your black permanent marker to draw these shapes on copy paper, then test your Optibots.
10. Investigate how the sensors activate your Optibot's motor. Look at the bottom of your Bot and find the sensors in the holes. Try covering the set of sensors on the right with your fingers and observe; then cover the left set of sensors and observe the motors.

 Any time a sensor "sees" a dark line, it activates the motor on the opposite side, steering the Bot back to the middle of the black line on the course.





PERSONALIZE YOUR OPTIBOTS

1. Personalize your Optibots using adhesive gems and permanent markers. You can also add things you find around your home, like buttons or stickers.

Don't cover the bottom of your Optibot!
It can affect the sensors.

2. Pick out names for your Optibots and fill out a Spec sheet for each of them.



DESIGN AN OCEAN COURSE



1. It's time to take a deep dive with your Optibots! Create a new course by taping together 6 pieces of copy paper (3 pieces long by 2 pieces wide).
2. Use the taped side as the bottom and on the top, use your black permanent marker to draw a thick course.



3. For inspiration, watch the "Alvin" video and learn about the deep sea submersible invented by NIHF Inductee Harold Froehlich.

Learn more about Froehlich here:
invent.org/inductees/harold-froehlich



4. Design an underwater course using the ocean stickers. Use the clay to create coral arches and other features!



Make a big course! You can use large white paper such as chart paper, rolled paper, or the backside of wrapping paper.



5. Start playing the "Aqua" video to set the scene.
6. Watch the Optibots navigate your ocean course as Remotely Operated Vehicles (ROVs).



CREATE A FOREST COURSE



1. Your Optibots are ready to move from the ocean to the forest. Create your best course yet by taping 6 pieces of paper together, then draw another thick path for your Bots to follow.
2. Use the clay to make animals, trees, and other forest features.
3. Place the Optibots on the course and have them traverse the forest.

BUILD A PARTY COURSE



1. Get ready to party! Choose one of your existing courses or create a new one, then add objects like paper cups, wooden blocks, or toy figures to design a Party Course.



2. Create tunnels and other fun obstacles for your Bots to move through and around.



3. Start playing the "Party Course" video.



4. Dim the lights, start your Bots, and put your Party Course features to the test. Use your finger flashlights to cheer on your Optibots!



MORE TO EXPLORE!

Optibot is a line-tracing robot that senses light. It has two **motors** activated by two infrared (IR) **sensors** that allow it to follow a black line. When light falls on a white surface, it is almost fully reflected; when light falls on a black surface, the light is almost fully absorbed. When both sensors detect light reflected by a white surface, both motors are activated, causing the Bot to move forward. When both sensors detect a black surface, neither motor is activated, causing the Bot to completely stop. When one sensor detects a white surface and the other detects a black surface, the Bot will turn. The left motor will stop when the left sensor is on a black line, and the right motor will move forward (this will make the Bot turn left). The right motor will stop when the right sensor is on a black line, and the left motor will move forward (this will make the Bot turn right).



Modern vehicles have sensors, too. These sensors can detect things like airflow, temperature, seat pressure, vehicle speed and oxygen levels. They can even tell if seat belts are used, a door is open, or the windshield is cracked.

Many cars on the road are already partially autonomous, meaning the driver has some control, and sensors and computer automation fill in the rest.

Fully autonomous vehicles have hundreds of sensors used for navigation and guidance, directing the vehicle, ensuring optimal vehicle response in all weather, following the rules of the road, and controlling the car's internal operating systems.

What other ways might sensors be used for transportation and beyond?

For more hands-on STEM activities,
[visit invent.org/at-home-learning-resources](https://www.invent.org/at-home-learning-resources)



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