The 2024 Advanced Vertical Robotics (AVR) competition will equip the DEXI done with an onboard laser that competitors will use to shoot at targets. This guide will show competitors how to re-create the real target that they will face for the competition. This document will show you the exact parts you will need, and a real code snippet sample from the field control system that you can use to flash to an Arduino and simulate your challenge.

A close-up of a blue circuit board

Description automatically generated

We will use this commercial off the shelf part. The TCS3200 is a color sensor. It uses a TAOS RGB sensor. An array of photodiodes that conduct electricity based on the color it sees and a current to frequency converter to generate a square wave to be interpreted by the Arduino. It also has 4 white lights designed to illuminate the object the sensor is looking at.

These lights are not needed in this use context. You may optionally bend them out of the way or remove them entirely. On the 2024 AVR courts the LEDs will be left in place and bent out of the way.

With that brief tech talk out the way let’s look at the build.

What you will need:

|  |  |  |  |
| --- | --- | --- | --- |
| Part | QTY | Seller | Suggested Links |
| TCS3200 Color Sensor | 1 | Amazon | <https://a.co/d/7dAYYYL> |
| Brass M3 Threads | 4 | Amazon | <https://a.co/d/3EnqoOf> |
| M3 10mm Bolts | 4 | Amazon | <https://a.co/d/72mEKN0> |
| PLA+ (white) | 1 | Amazon | <https://a.co/d/20TKjVD> |
| Light Diffuser. | 1 | Home Depot | <https://www.homedepot.com/p/Westek-Ultra-Thin-LED-White-Puck-Light-2-Pack-BL-PUTN-W2T/315068101> |

A white roll of paper with a blue circuit board attached to it

Description automatically generated**Step 1:** Print out the laser cup. Use the attached STL. Depending on the tolerance of the material and the printer you use, you may need to use a finishing tool to make the laser hole a few mm wider to accept the sensor housing.

**Step 2:** Add the brass threads. I bent the LEDs on the light senor back and to the side to get them out of the way. Then pressed the black sensor housing to mark the screw hole locations with a pencil. Use a soldering iron to heat press the threads into place.

A close-up of a gold metal

Description automatically generated

**A roll of white paper with a black and silver metal piece

Description automatically generated with medium confidence**

**Step 3:** Connect the sensor to the cup using 4 M3 bolts. 1 per corner.

**A white object on a black surface

Description automatically generatedStep 5:** Disassemble the light pucks to harvest the refractor lens. Place a bead of hot glue around the ledge inside the printed frame and lay in the lens. The concave end must face the outside and the convex end must face the sensor.

**Step 6:** Connect the sensor to your microcontroller using the following recommended pins for use with the sample code. You may do this however you like. We recommend you use Dupont connectors for simplicity.

|  |  |
| --- | --- |
| TCS3200 Pins | Arduino Pins |
| SC0 | 5 |
| SC1 | 6 |
| SC2 | 8 |
| SC3 | 7 |
| OUT | 9 |
| VCC | 5V |
| GND | GND |

**Step 7:** Flash the “laserBench” INO script to your Arduino. No libraries required.

**Step 8:** Monitor the output. The program will print only when it registers a hit. Note: you must be precise when firing lasers.

A red light on a black surface

Description automatically generated**Step 9:** Practice shooting. The sensitivity and debouncing will be set as with what you are testing in this guide.

Best of luck!