PRIME LESSONS
By the Makers of EV3Lessons

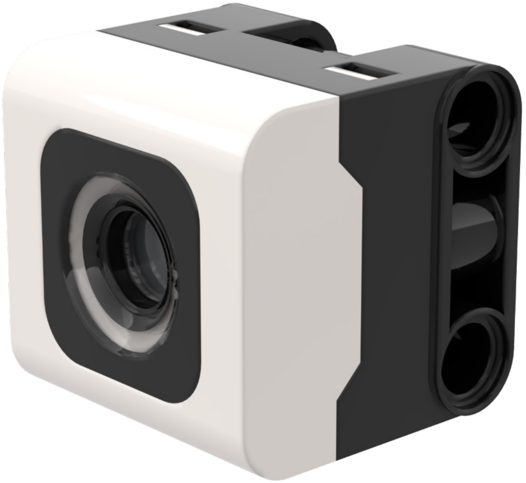
INTRODUCTION TO COLOR SENSOR

BY SANJAY AND ARVIND SESHAN

This lesson uses SPIKE 3 software

LESSON OBJECTIVES

Learn how to use the Color Sensor



WHAT IS A COLOR SENSOR?

The sensor API can report either the color or reflectivity measured

Unlike the EV3, reflectivity is measured while shining a white light, not a red light.

Optimal reading distance according to the specs: 16 mm (depending on object size, color, and surface)

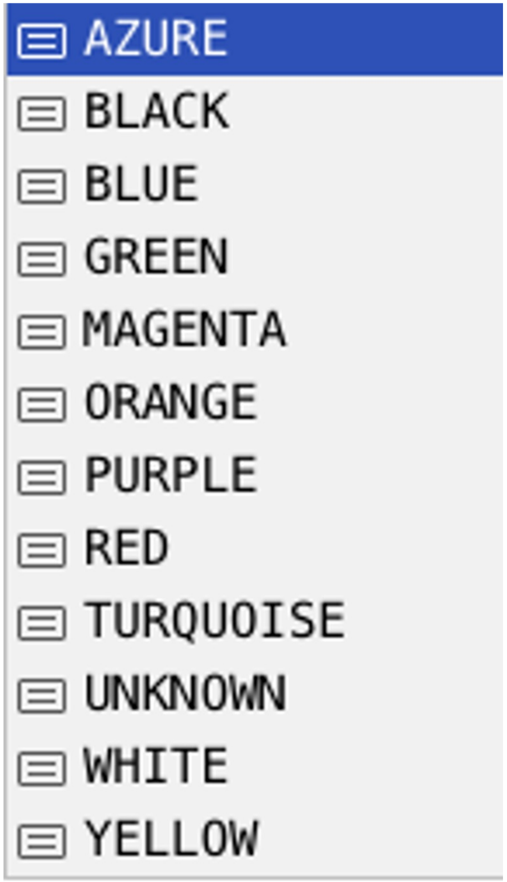
The sensor can report the colors (shown on right). No color or unrecognized color is the UNKNOWN value.

The sensor can report reflection. It is percentage from 0 (no reflection) to 100% (total reflection)

The sensor can report raw red, green,blue, intensity (rgbi) values as a tuple

Note: In testing v3.4

- Orange color could not be recognized.
- The r,g,b,i value ranges are unclear and not documented in the Knowledge Base.



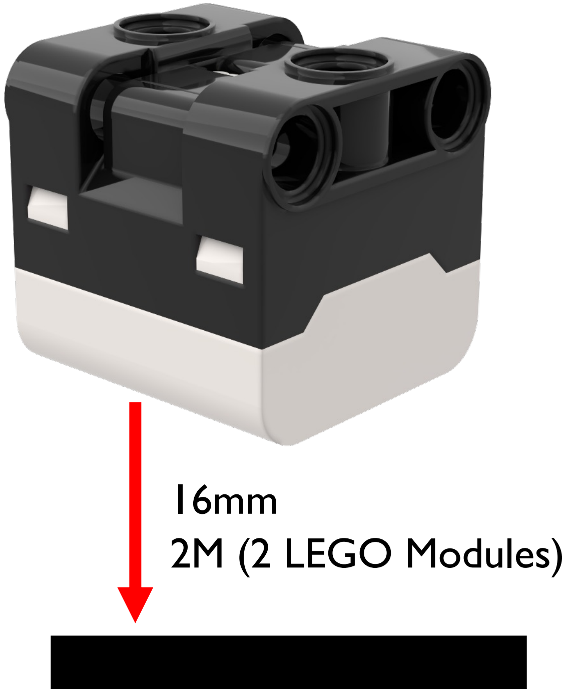
AZURE
BLACK
BLUE
GREEN
MAGENTA
ORANGE
PURPLE
RED
TURQUOISE
UNKNOWN
WHITE
YELLOW

NOTE: ADB AND SENSING COLOR

The color sensor on ADB is mounted at about 8mm off the ground, but the optimal distance for mounting the sensor according to the specs is 16mm.

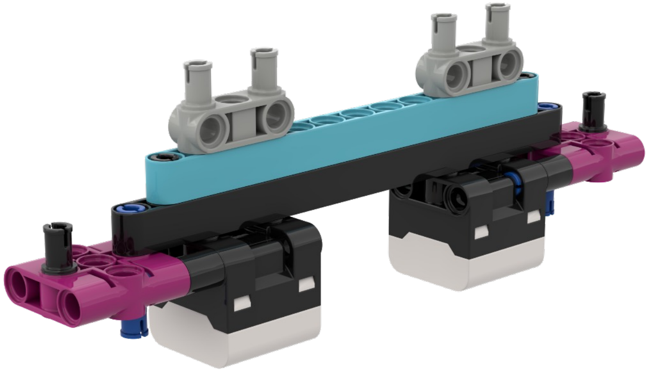
When using this robot design, Black does not read correctly in Color Mode using electrical tape lines or a FIRST LEGO League challenge mat.

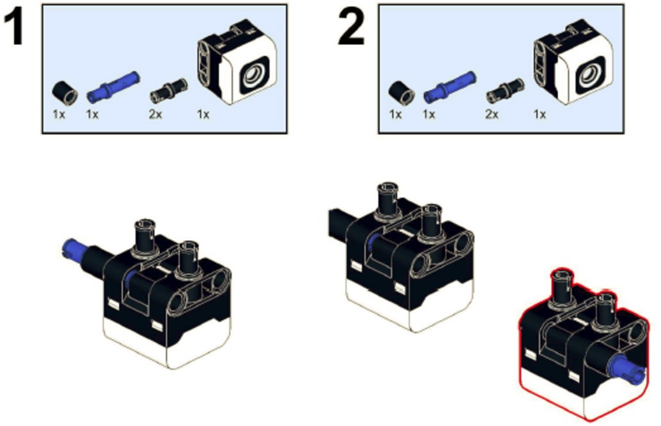
See the next slide for modifications. The build instructions are also provided as a separate file on our site.

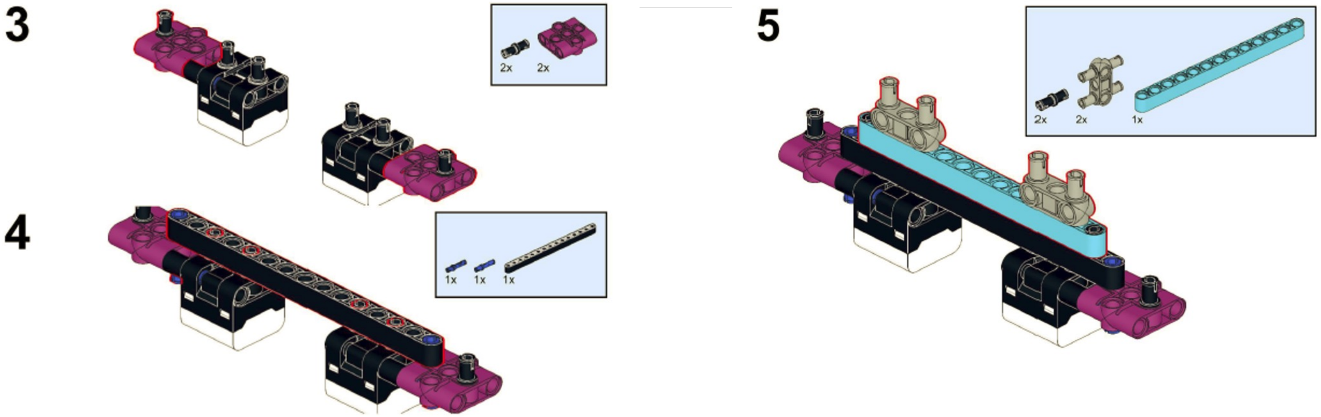


MODIFICATIONS TO ADB

Build instructions for modifying the front bumper of ADB so that the color sensors are raised one LEGO module up are included on this website







(Last edit: 09/17/2023)

HOW DO YOU PROGRAM WITH A COLOR SENSOR?

The two modes you can program the color sensor in: Color Mode and Reflected light mode

Reading a color:

```
color_sensor.color(port.A)
```

Port

Reading an intensity:

```
color_sensor.reflection(port.A)
```

CHALLENGE 1

Program your robot to move straight until the color sensor sees black

Basic steps:

Write a color_found function that returns true if it sees black

Set the **movement motors** for your robot

Start **moving straight**

Await the color_found function

Stop moving

The solution on the next page uses Drive Base 1 with a color sensor on port A. Adjust your program accordingly.

CHALLENGE 1: SOLUTION USING COLOR

```
from hub import port
import runloop, motor_pair, sys, color_sensor, color

# Function that returns true if the color sensor sees black
def color_found():
    return color_sensor.color(port.A) == color.BLACK

async def main():
    # Set up the pair and start moving
    motor_pair.pair(motor_pair.PAIR_1, port.C, port.D)
    motor_pair.move(motor_pair.PAIR_1, 0)
    # wait until color found
    await runloop.until(color_found)
    # stop and exit
    motor_pair.stop(motor_pair.PAIR_1)
    sys.exit("Done")

runloop.run(main())
```

CHALLENGE 1: SOLUTION USING REFLECTION

```
from hub import port
import runloop, motor_pair, sys, color_sensor

# Function that returns true if the intensity is less than 50. This works for a black-white
# mat. If your mat has more colors, use a lower threshold value for black.
def intensity_found():
    return color_sensor.reflection(port.A) < 50

async def main():
    # Set up the pair and start moving
    motor_pair.pair(motor_pair.PAIR_1, port.C, port.D)
    motor_pair.move(motor_pair.PAIR_1, 0)
    # wait until intensity found
    await runloop.until(intensity_found)
    # stop and exit
    motor_pair.stop(motor_pair.PAIR_1)
    sys.exit("Done")

runloop.run(main())
```

CREDITS

This lesson was created by Sanjay and Arvind Seshan for Prime Lessons

Additional contributions by FLL Share & Learn community members

More lessons are available at www.primelessons.org