

Unit 2: Skill Builder 3 - Color Sensor

Goals:

In this activity, you will learn to read and display RGB colors. You'll also learn how to send the rover to specific (x,y) coordinates.

1. Use the color sensor mounted on the bottom of Rover to make measurements of color on the drive surface.
2. Use the RGB LED mounted on the top of Rover.
3. Use the send to XY command to send to coordinates

Background:

What is Color?	<p>Pure spectral colors of visible light are narrow wavelength bands of electromagnetic radiation that create a sensation when they strike the retina of the human eye. The color ranges indicated below are an approximation; the spectrum is continuous, with no clear boundaries between one color and the next.</p> <p>Violet 380–450 nm, blue 450–475 nm, cyan 476–495 nm, green 495–570 nm, yellow 570–590 nm, orange 590–620 nm, red 620–750 nm</p>
How do colors mix?	<p>There are two types of color mixing, Additive and Subtractive. In both cases there are three primary colors, three secondary colors (colors made from 2 of the three primary colors in equal amounts), and one tertiary color made from all three primary colors.</p> <p>1. Additive – Additive color mixing is the kind you get if you overlap colored spotlights in a dark room. The primary colors for additive color mixing are red, green and blue. This process is called additive because colored light is being added.</p> <p>2. Subtractive – Subtractive color mixing is the kind you get with paints and pigments. Subtractive color mixing can be demonstrated with filters that absorb particular colors of light from white light. For example, white light possesses all of the spectral colors, the pigment in a red shirt will absorb or subtract out of green and blue light while reflecting the red light to the viewer's eye. The primary colors for pigments are cyan, magenta and yellow. They are called primary because they absorb only one primary color from white light. For example yellow, a primary pigment, absorbs blue light and reflects red and green. The reflected red and green are perceived by the human eye as yellow.</p>
Black and White	<p>When all three primary color of light are added, white light is produced. Black is the absence of all light. Black pigment absorbs all incident light and reflects none to the eye, while white pigment absorbs none of the light and reflects all of the colors to the eye. This is also why black clothing is hot while white clothing is cool.</p>
Rover's RGB LED	<p>The color RGB LED on the Rover has three parameters; the value of red, the value of green and the value of blue. For example Send "SET RV.COLOR 255 128 0" produces yellow illumination of the Rover's LED. This RGB color space can be set to mimic most of the colors the eye can perceive.</p>
Rover's Color Sensor	<p>The color sensor on the bottom of the rover detects pigment color. The white LED that accompanies the color sensor, shines a full spectrum white light onto the pigment. The color sensor then measures the values of the reflected red, green and blue light. For example, if Rover drives over a yellow colored piece of construction paper, the white LED will shine red, green and blue light upon the paper. The yellow pigment then subtracts out the blue light and reflects the red and green light. The sensor then measures the value of the red and green light. For example when the command "READ RV.COLORINPUT" when driving over yellow, the return values will be 255, 255, 0 indicating strong red and green light reflection and no blue light reflection.</p>

Command	Example	Behavior
"READ RV.COLORINPUT.<color>"	Send("READ RV.COLORINPUT.RED")	Reads the color directly below the front of the Rover and returns that reading to the calculator when the program requests it with the Get command, in this example, just red is measured. The returned value ranges from 0 to 255 where 0 means there is none of the color component present, while 255 means the color is fully present. This command, in addition to red, also works for green, blue, and gray.
"READ RV.COLORINPUT"	Send("READ RV.COLORINPUT")	Reads the color directly below the front of the Rover and returns that reading to the calculator when the program requests it with the Get command. The returned values are 1 through 9 and are matched to particular colors. The color numbers are: 1-red, 2-green, 3-blue, 4-cyan, 5-magenta, 6-yellow, 7-black, 8-white, 9-gray.
Get(variable)	Get(color)	The Get command retrieves the value returned to the calculator from the Hub after a READ command is issued. The Get command must immediately follow the READ command. In the previous example the color measurement is returned and stored in the variable named color.
"SET RV.COLOR.RED <value>"	Send("SET RV.COLOR.RED 128")	Sets the color of Rover's RGB LED to a medium brightness red. The value can range from 0 to 255. This command also works for green and blue components of the LED.
getKey	getKey→K	Returns the last key pressed as a two digit number, row number counting from the top of the keyboard and column number from the left, to the variable named K. e.g. the number 1 key is returned as 92 (9 th row and 2 nd column) and the clear key is returned as 45 when the value of K is accessed.
"READ RV.WAYPOINT.CMDNUM"	Send("READ RV.WAYPOINT.CMDNUM")	The CMDNUM is used as a way to check if the Rover has finished driving its path. A value of 1 means the Rover has finished. A value of 0 means the Rover is still completing its path.
Send "RV TO XY <value> <value>"	Send("RV TO XY 5 3")	Sends the rover to the given x and y value relative to the initial starting position (0,0)

Challenges:

Challenge 1: Create a program named **c1** that uses the color sensor to continuously read the red, blue, and green color directly below the front of the Rover and use the color measurement to set the RGB LED on the Rover to match. Display and label the RGB numbers on the calculator. Test your program by placing the Rover's color sensor on top of construction paper of various colors.

Challenge 2: Create a program named **c2** that drives the Rover forward and has it stop when it drives over a piece of blue construction paper placed anywhere along the forward drive path.

Challenge 3: Create a program named **c3** that uses the "RV to XY" command to drive the Rover on a regular triangular path. Plotting your path on graph paper first might be helpful.