

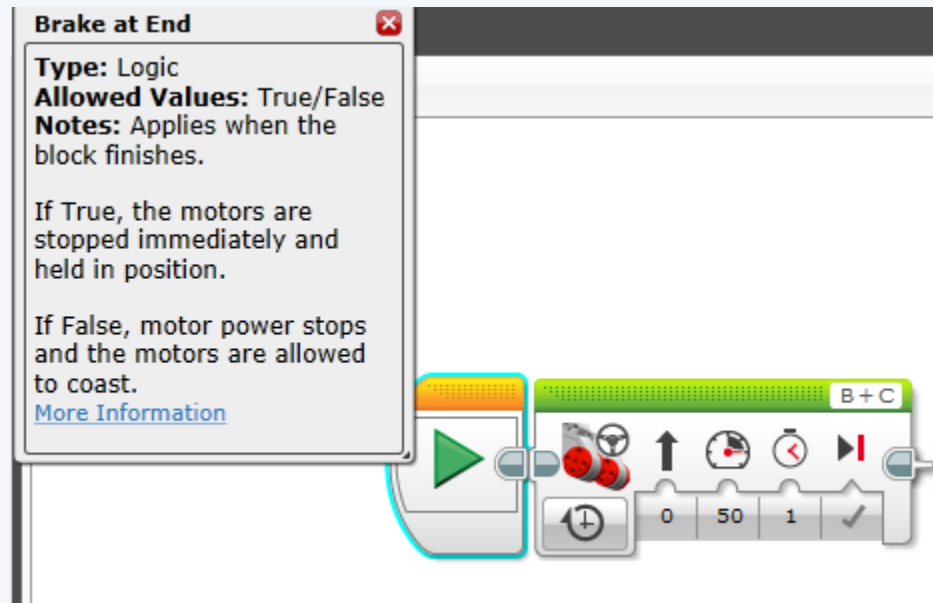
Loops, Sensors, and Conditionals

Slides

- Many slides for the robotics sections come from:
- Elements of Robotics, Authors: Ben-Ari, Mordechai, Mondada, Francesco
- Lego Material
- <https://cs4hsev3robots.appspot.com/course>

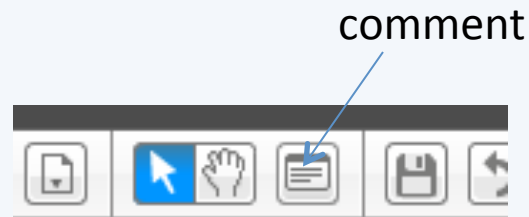
Help

- You can find out about any block and its components by going to the help menu and select **show context**.
- Then as you touch any block it will tell you what it does.



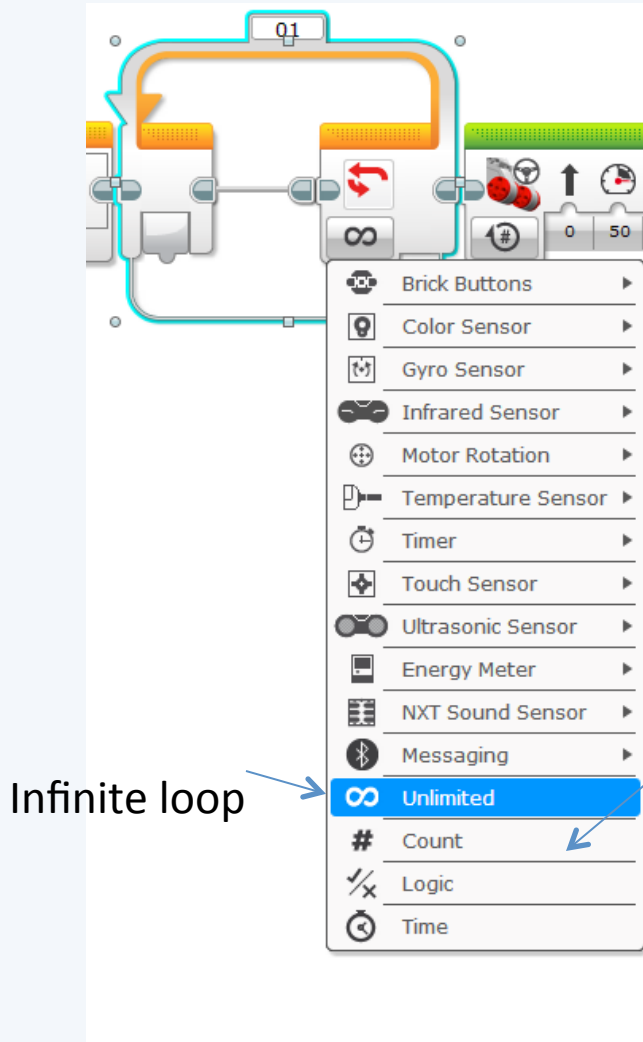
Comments

- You can comment your program which will help you remember what your program does.



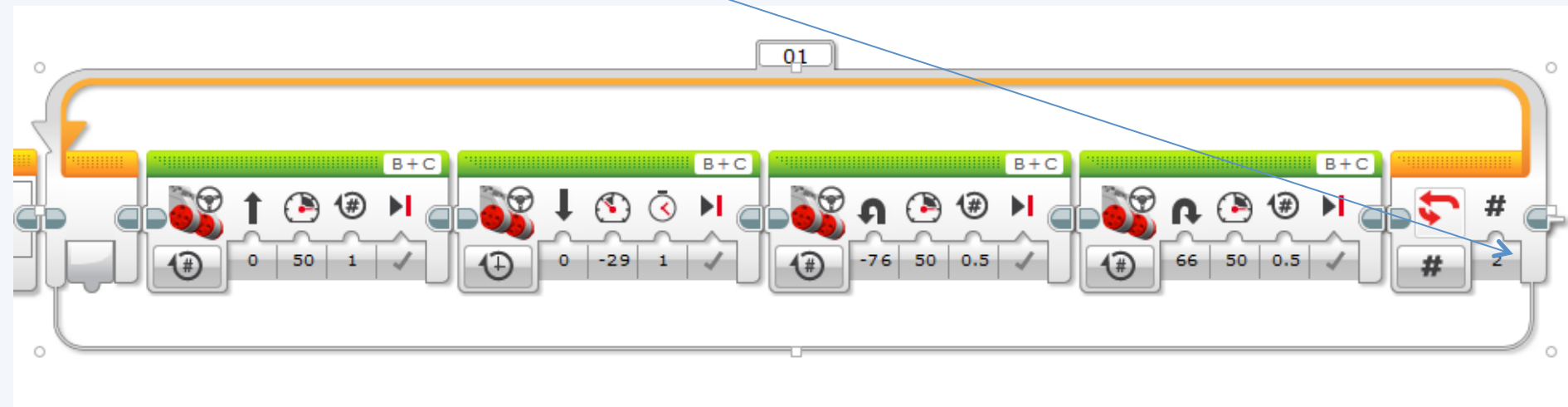
Loops

- Last week we showed count-controlled loops.

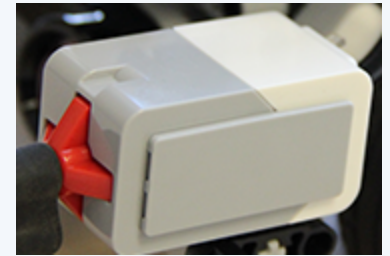


Count-controlled Loop

- Do it 2 times



Touch Sensor



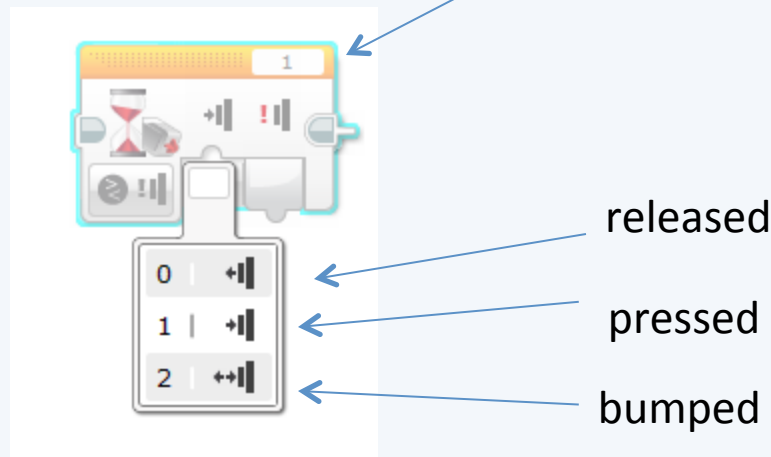
- When the Touch Sensor is pressed, it closes an electrical circuit, allowing current to flow. If the Touch Sensor is released, the circuit is broken and no current flows.

The flow (or lack) of current is detected by the EV3, allowing it to determine if the Touch Sensor is pressed.

Touch Sensor

- Released – released
- Pressed – pressed
- Bumped – pressed and released

Hook it up to port 1.

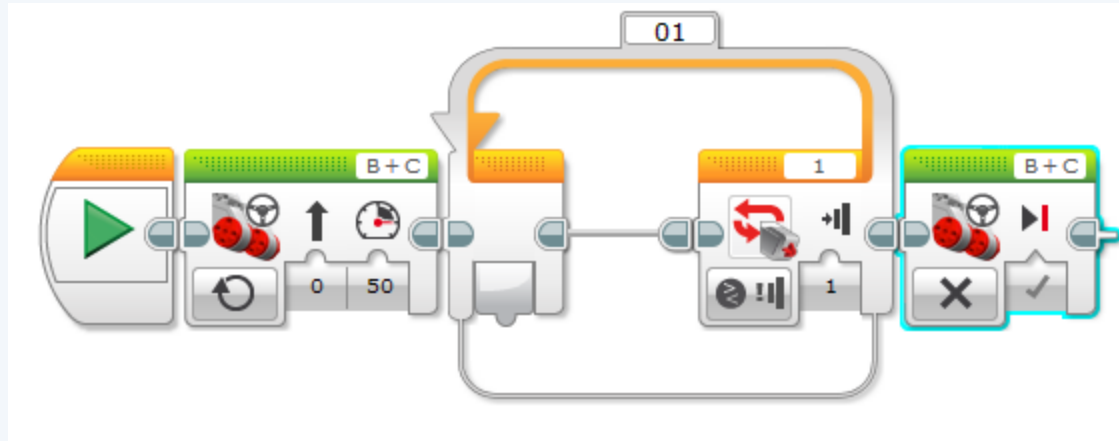


Let's write a Program Together

- How can I write a program that will continually move and stop when it hits an object ?
- How should I write the program – let's try!

What is in the loop?

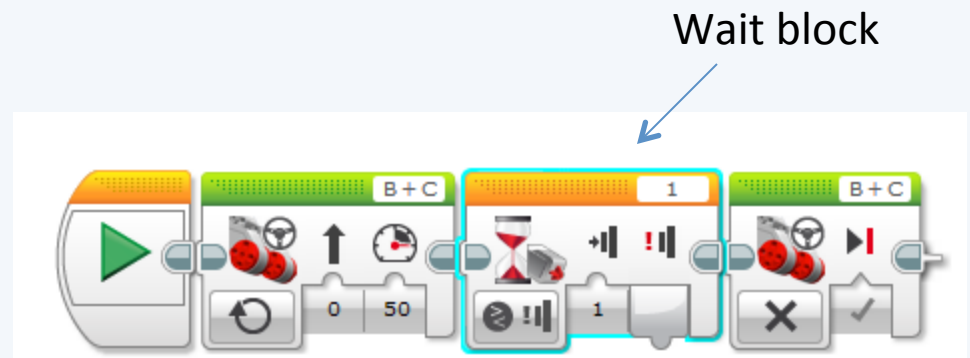
- Technically we don't need anything in the loop...this will work but it is weird...



Wait block

- Instead of an empty loop we can use a wait block.
- Wait can work with any sensor.
- We can wait until the touch sensor is pressed and then stop!

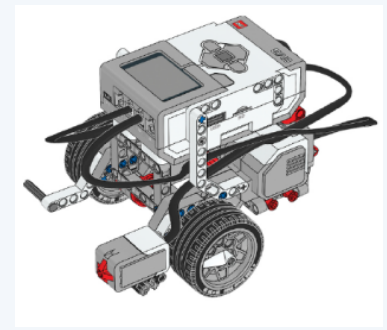
- Wait until touched
- Much nicer!



Touch Sensor

- Touch Sensor can be used as a human interface device:
 - A press to start Button
- Touch Sensor can be used as a bumper.

In Class Exercises: Vacuum Cleaner Bumper



- Build the touch sensor attachment if you haven't (Pages 77-80) and connect to Port 1.
- Write a program that drives until it hits something (You can use Wait - Touch Sensor > Compare > State)
- Then have it back up and turn and continue to drive straight again.

- **Extra time:**
- Add some sounds (and/or image) when it hits something or is backing up.
- Try changing the brick lights as well (using the Brick Status Light block).

Touch Sensor, Recap

- That was very nice that we could stop ourselves after we hit a wall, object, or even a person!
- But wouldn't it be better to stop ourselves before we hit something?
- What sensor can we use?

Ultrasonic Sensor

(0 – 100 inches)

(0 – 255 centimeters)

- Sensor reports how far it is to an object in front of it.
- Sends an ultrasonic ping (sound waves) and figures out how long it takes for the “ping” to return (echo back).
- Think of it like a tennis ball hitting a wall if it takes a longer time for the ball to return you are farther from the ball.
- If nothing will return 100 (if in inches or 255 if set to centimeters),
Ex:
 - No wall – it will never return.
 - Wall too small – may not hit it and won't return
 - Too close, ball may return at too steep an angle and not make it back.
 - Some materials may not work and will absorb the ball.

In Class Exercises: Self-Driving Cars

- **Exercise:** If you haven't, connect ultrasonic sensor to the front of robot (pages 42-47) and connect to Port 4.
- Now, write a program that will drive and then stop when it is getting close to an object (<25cm away). Try it.
- **Next, do the following:**
- Write a program that will back up and turn when it's getting close to an object. See what happens.

Self-Driving Cars

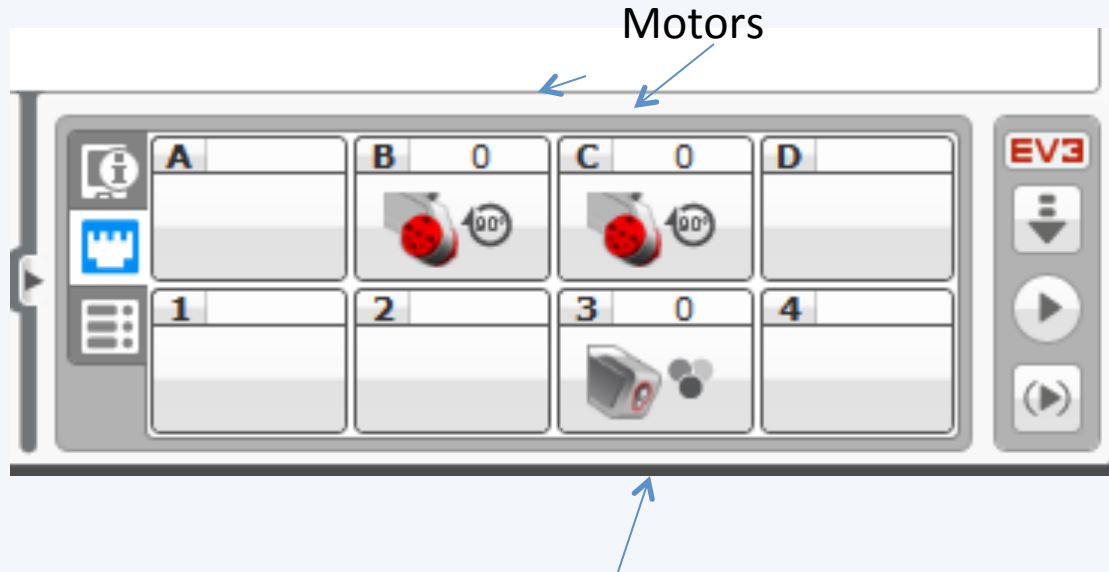
- In addition to staying on the road, self-driving cars need to know how to obey traffic signals and signs.
- Ex. Traffic Light
 - Red means stop
 - Green means Go
- We will do this!

Sensors: Color Sensor

- Color sensor –
 - Detects 1 of 7 colors or no color.
 - Color sensor is not perfect. For example, red needs be the red color (or close) of a lego brick. And it needs a good view of it.



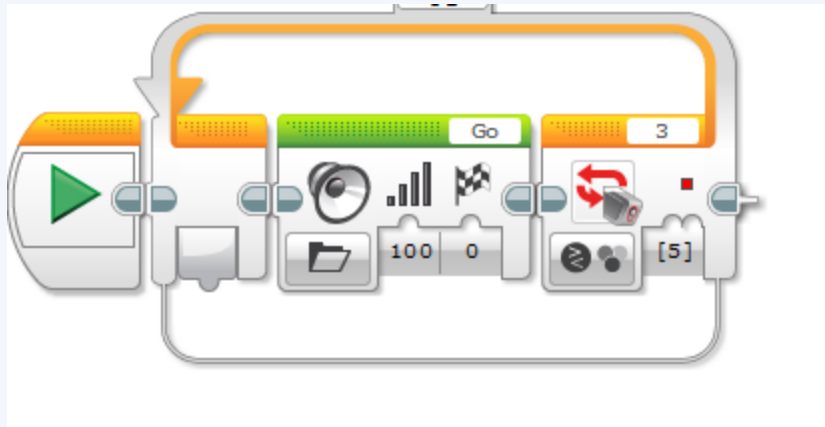
Port View



Color sensor in port 3

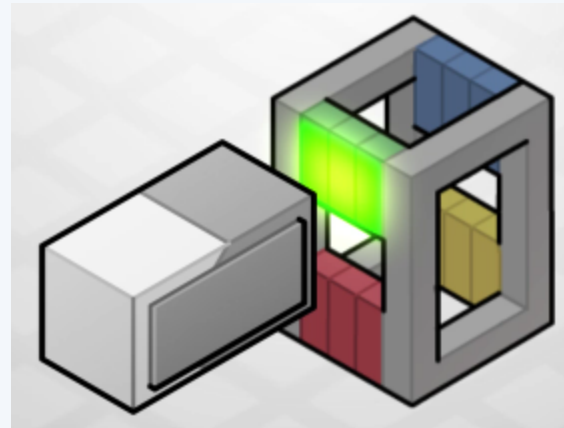
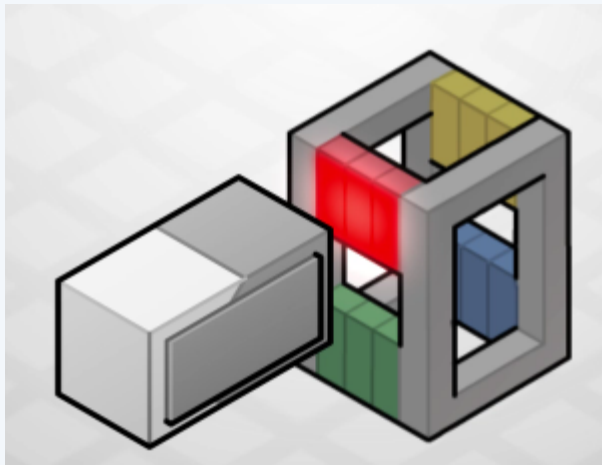
Let's try Color

- Color sensor –Expecting it to be in port 3.
- Will keep saying Go until it see RED.



Red and Green Light

- We will detect whether there is green or red ahead. Using the color block we built as our traffic light.



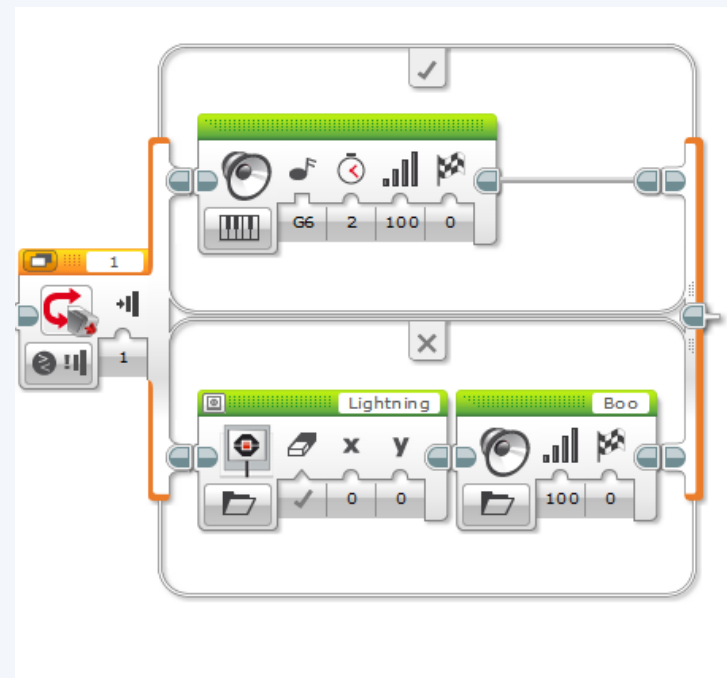
In Class Exercise: Traffic Light



- Add the color sensor component if you haven't (pages 73-76).
- Create the color block if you haven't (pages 4-6)
- Program: Using a wait block – have your robot wait until the light is green and then go (use color sensor>compare and then select the color green and uncheck red!).
- Add another Wait to wait for red, and then stop.
- Place your color block with red in front of robot, then flip it and it should go. Flip it again and it should stop.
- Put it in an infinite loop to see it multiple times
- Remember to keep flipping the red and green light to get it to stop and go.

Switch Block

- Conditional : if/else's
- In Flow control – Switch
- If the touch sensor is pressed (true – go to top) – play note G6 for 2 seconds.
- Otherwise, say Boo

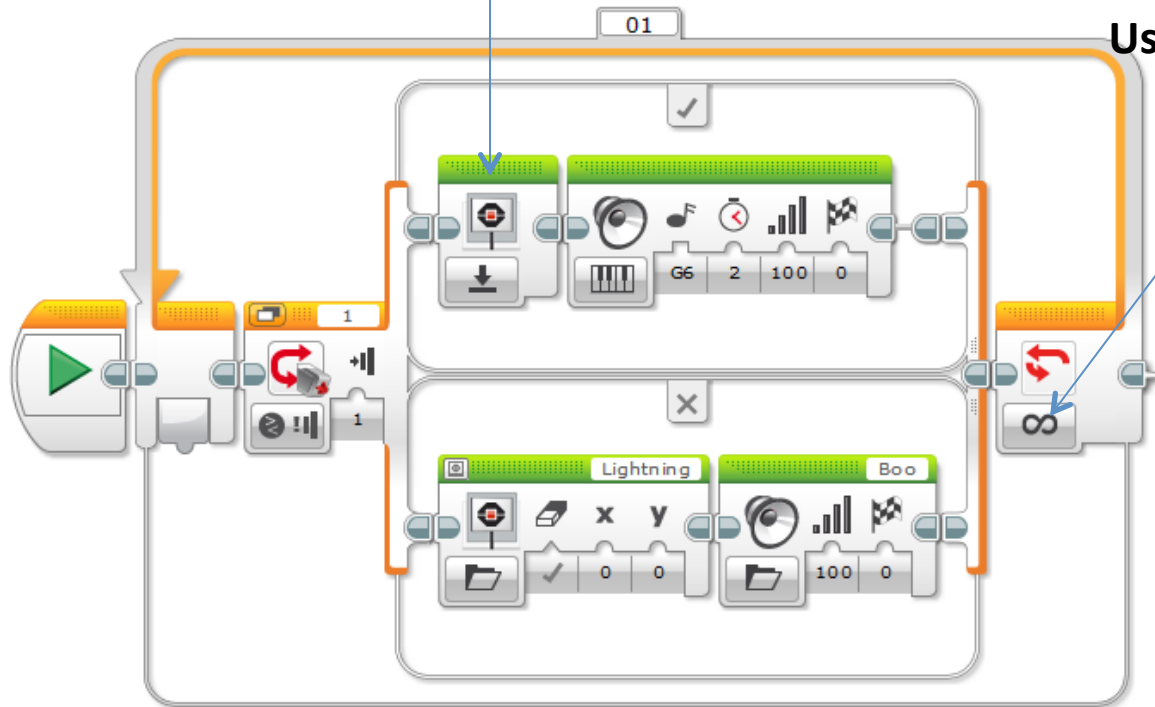


Switch in a loop

- You can put it in a loop for 6 seconds.

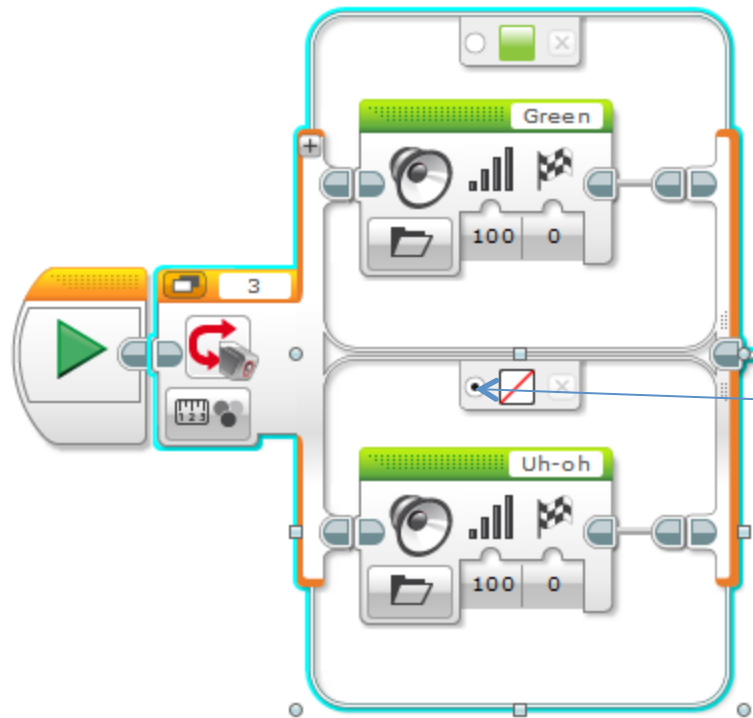
Display block set to reset screen. So lightening is no longer on it if false then true

Change it to 6 seconds
Using time



Switch Block

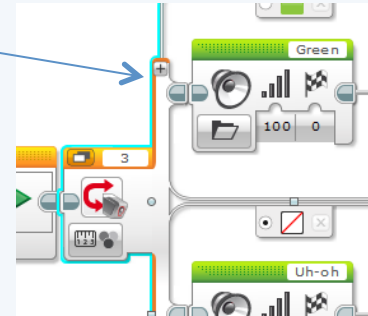
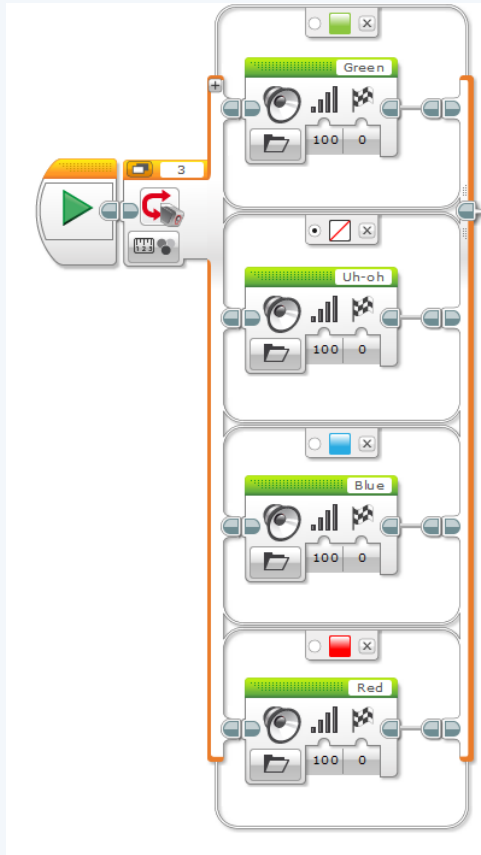
- Color Sensor detects 7 colors.
- Says green if sees green says Uh oh otherwise.



The **else** is the one with the **black dot**. Make sure the black dot is always for your default (Otherwise case).

Switch Block with Multiple Cases

- Hit + to add a case



Default case

In Class Exercise: Switch and Colors

- Create a program that can detect each of the 7 colors Lego has available and says it out loud.
 - It should be in an infinite loop always looking for colors.
 - If it sees red, it should say “Red”, if it sees yellow it should say “Yellow.”
 - Test it with the color block.
 - Try it with the colors in the classroom and see if it works.

Extra Time – try this – Switch and Ultrasonic Sensor:

- Create a program that uses a switch statement to detect whether it is <25 cm from an object – if it’s less it can turn otherwise, it can go straight.



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