More Robot Sensors and Math

Slides

- Many slides for the robotics sections come from:

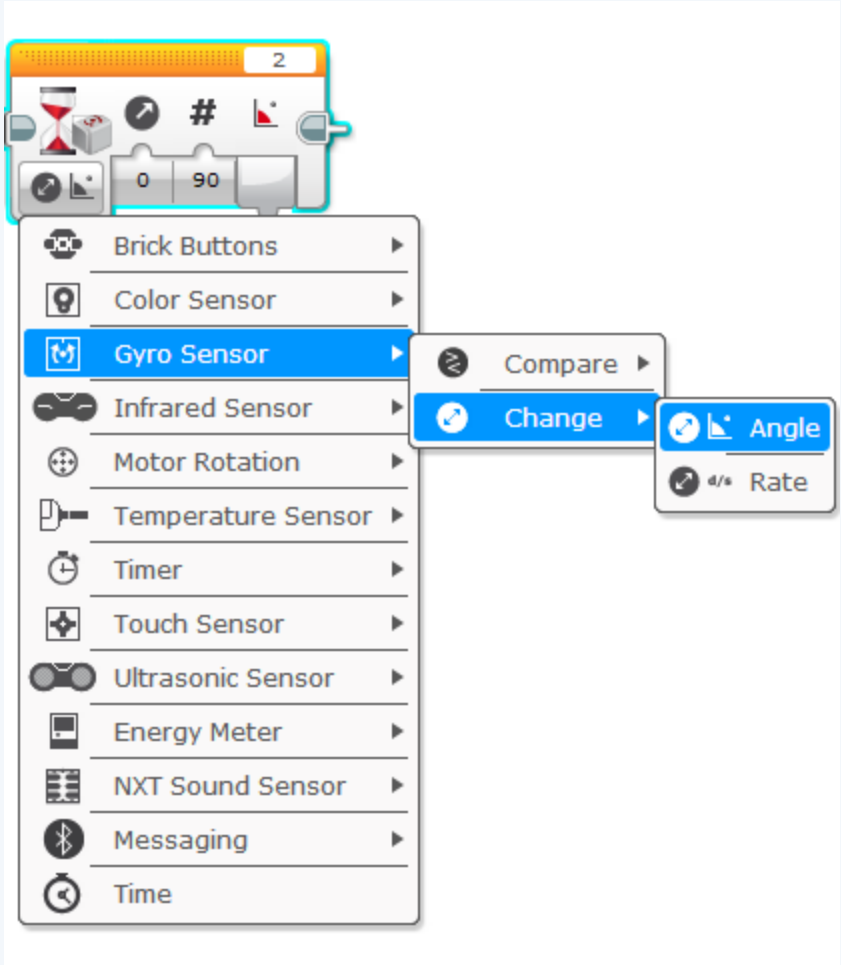
- Elements of Robotics, Authors: Ben-Ari, Mordechai, Mondada, Francesco
- Lego Material
- https://cs4hsev3robots.appspot.com/course

Gyro Sensor

- Gyro sensor will tell us in degrees which way we are heading.

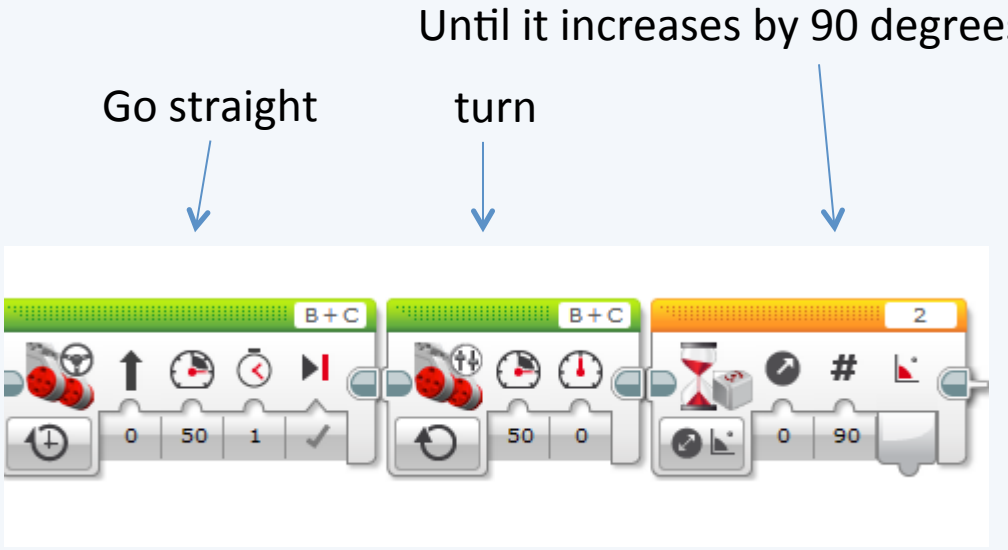
Change Mode in Wait Block

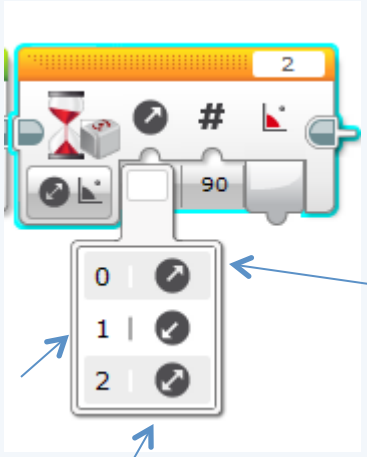
Wait for a change of 90 degrees.



Gyro Sensor

- Let's program our robot to use the gyro sensor to turn the robot 90 degrees.
- What happened?





Decrease (negative /left)

increase

any

Gyro issues

1. The sensor is accurate within 3 degrees so 90 can be 87-93.
2. Gyro Sensor Lags – the readings lag behind the movements and true values. Because it is complex, it takes it some time to detect and process the motion and send it to EV3. These delays add up.
3. Momentum – wheels may still be turning a little at the end even when they are told to stop.

Compensate

- Since it will always be delayed, we can compensate.
- If you want to turn 90 degrees – tell it to wait until 80 degrees instead!
- To lower momentum, can lower power from 50 to 40.
- Let's try it!
- Note: These are workarounds so results may be a little inconsistent.

In Class Exercises

- Attach the Gyro Sensor (pages 48-52).
- Find a square or rectangular object.
- Your robot should drive around the object using the gyro sensor to make each turn.
- If extra time:
  - Try some other objects which are different shapes and try to go around them.

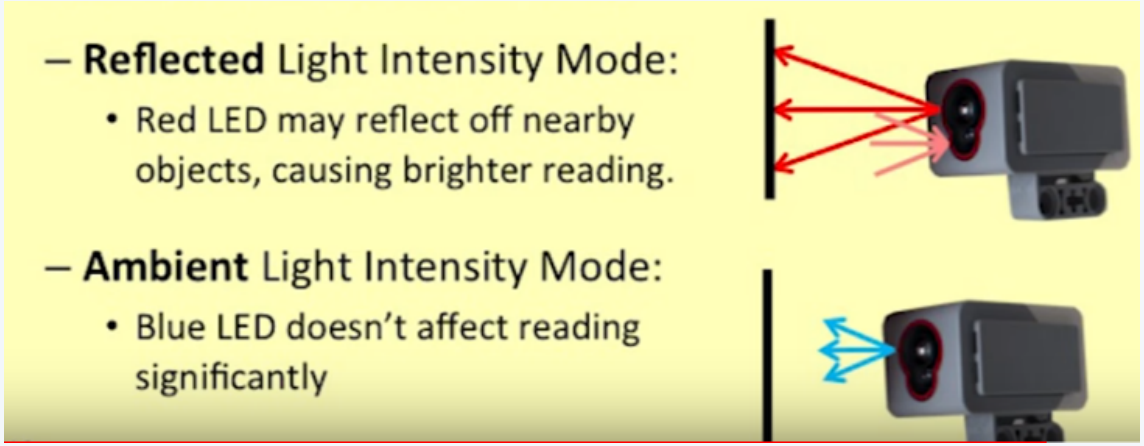
Sensor: Color (light) Sensor

- Color sensor – Also has a Light Mode:

  0= very dark 100 = very light

Reflected –measures how much light bounces back up.

Ex. your robot might be programmed to move around on a white surface until a black line is detected



Ambient - the strength of light that enters, such as sunlight or the beam of a flashlight

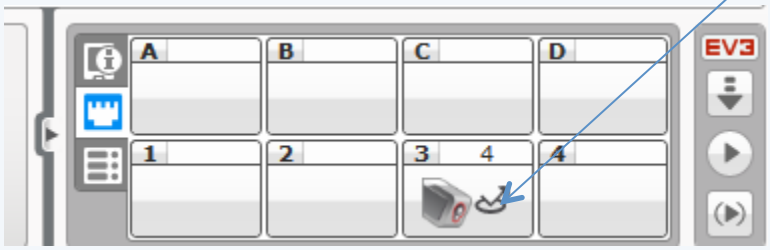
Ex. your robot might be programmed to set off an alarm when the sun rises in the morning, or stop action if the lights go out.

Follow a Line

- Dark and Light - can check the numbers that they are reading.

- Remember to change the setting to Reflected

- So you can use these values to follow a line.



In Class Exercise

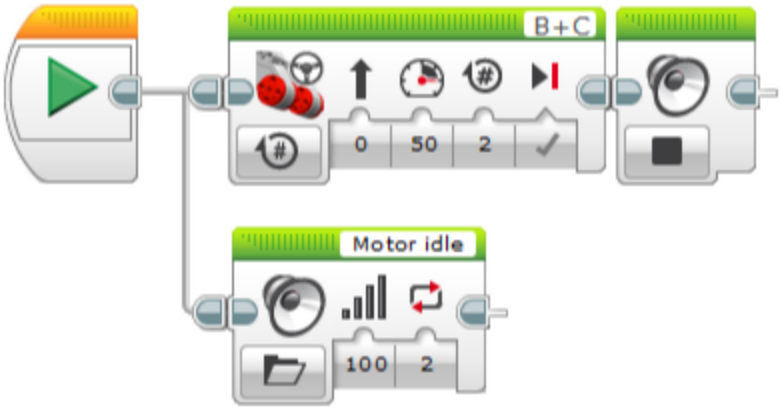
- Turn the color sensor on the robot so it faces down (Pages 70).
- Use reflected light to check if it's dark or light (decide on values by testing)
- Follow the line –
- Use the Move Tank block - If see dark turn a little (set one motor to 0), if don't see dark (off line) so go straight (slightly curved to the right again with the other power to 0).

http://www.legoengineering.com/inside-a-two-step-simple-line-follower/

Robot Educator

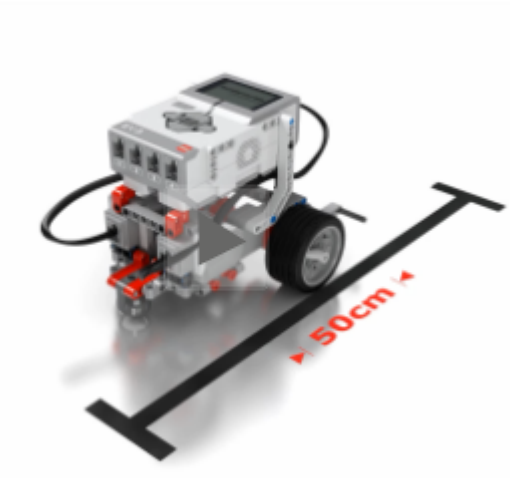
- Scroll through to see tasks.

Robot Educator: How to Multitask



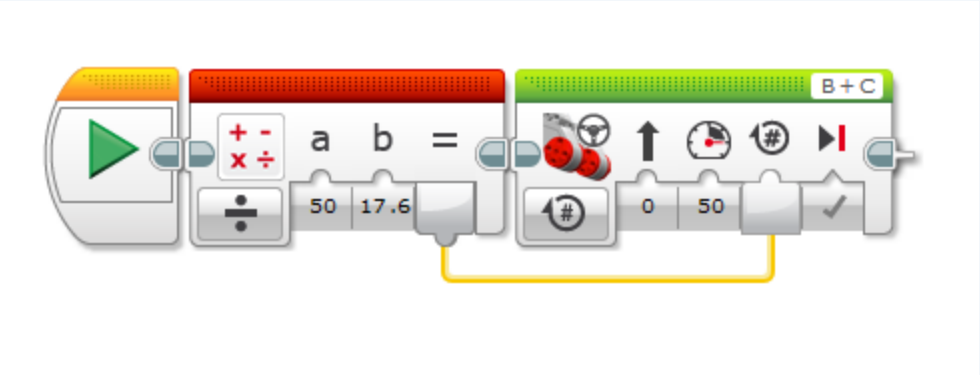
Robot Educator: Using Math

- Calculate how far your robot travels using Math on the robot!



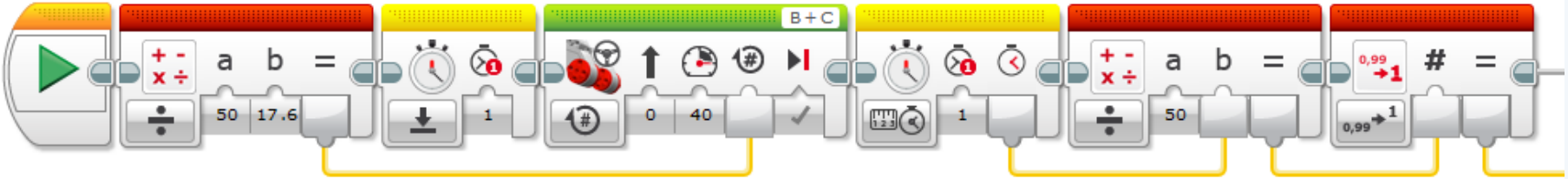
How do we do it?

- We learned that a rotation = 17.6 cm.
- If we want to drive 50cm, how many rotations?
- Divide 50/17.6 to get the number of rotations we should have the robot drive.
- Move steering that number of rotations!



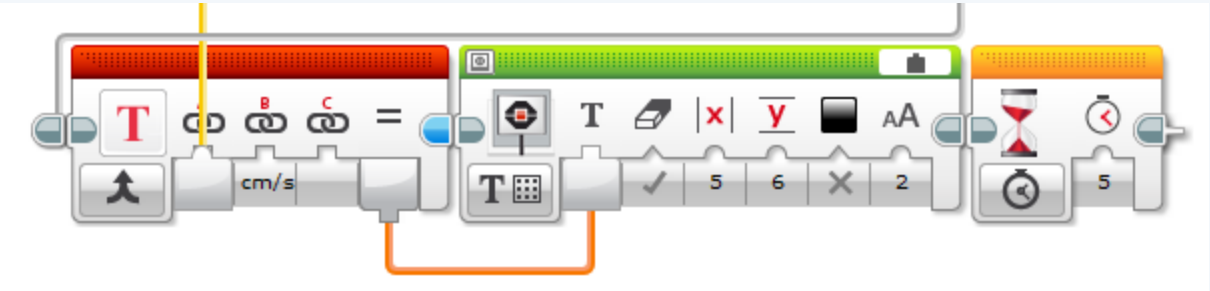
Measure Distance Per Second

- What if we want to know how many cm per second it traveled?
- To measure how many cm we traveled per second we would need a timer to keep track of seconds.
- Reset the timer before moving – then measure the time it took.
- Divide 50cm (our distance) by the seconds to get the time per seconds.
- Round to the nearest integer.



Display

- Concatenate/merge the amount with cm/s and display that to the screen.
- Wait 5 seconds so you can see the display



In Class Exercise

- Now you try it - Use Math to display how many cm/second your robot traveled. Test it!

- (If you are stuck you can look at the robot educator)

In Class Exercise

- Using everything we have learned create a program to do anything of your choice (that we have not yet done).

- Demonstrate it to the class after.