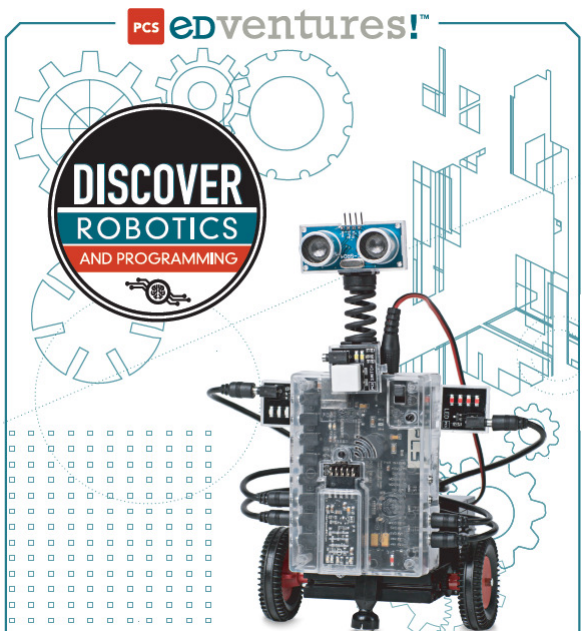
Intro to Robotics



Why a Robotics Class?

- Related STEM* careers pay well and graduates are in demand
- Learning math & science can seem boring but applying science and math to make robots do what you want can be fun and show why those subjects are important.

	Salary per year	
	Starting	Mid Career
Electrical engineer	$ 65,900	$ 119,100
Computer Science Engineer	$ 66,700	$ 112,600
Robotics Software Engineer	$ 71,000	$ 103,600
Mechanical Engineer	$ 62,100	$ 101,600
Software Engineer	$ 61,700	$ 99,800
Industrial Engineer	$ 61,900	$ 97,200
Robotics Engineer	$ 62,000	$ 95,000 +
Robotics Technican		$ 56,800

Frequently STEM careers open the door for career advancement into management with even higher pay

*STEM = Science, Technology, Engineering, Math

Who builds robots in school and what competitions exist?

- NBC-2 - FT Myers Team 2:05 min
  - https://www.youtube.com/watch?v=O4WfsDdSgPg
- 2018-2019 Vex competition rules and examples 2:50 min
  - https://www.youtube.com/watch?v=CDDGBcs0TFM
- First 2018 Championship (start second video 40 second into it)
  - https://www.youtube.com/watch?v=LGdWKRHUiog
  - https://www.youtube.com/watch?v=_8WmmRH_93Q
- FTC 8644 Brainstormers Robot Reveal Velocity Vortex 2016-2017
  - https://www.youtube.com/watch?v=mubp7TaJThA
- BEST Robotics Competition at University of West Florida
  - https://www.youtube.com/watch?v=lqFnFa1dYbA

Goals of the GP Robotics Class

- Learn about engineering and writing software though building robots and programming them to do certain tasks
- Have fun and a sense of accomplishment making a robot do things you want it to do
- Use knowledge gained to build you own robot in the GP robotics club should you desire
- Use knowledge gained to advance to the GGHS Engineering and Robotics Club if desired, competing at higher levels.

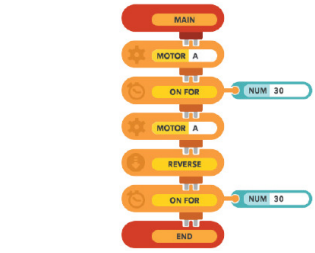
Today's discussion

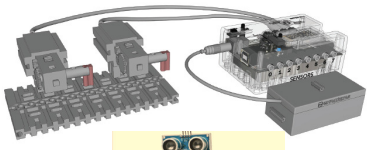
- Major activities of the class over next 6 weeks
- Journaling and Peer Assisted reviews
- The "Brain" and Cortex Programming introduction
- Sensors and motors introduction

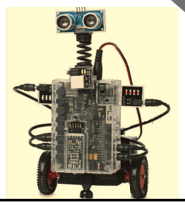
Major Activities over next 6 weeks

- Learning about the robot's "brain" and programing
- Building and programing motor testing station
- Programing and running motor tests
- Building a robot
- Programming the robot to do various activities

Having fun!







Journaling and Peer Assisted Reflection

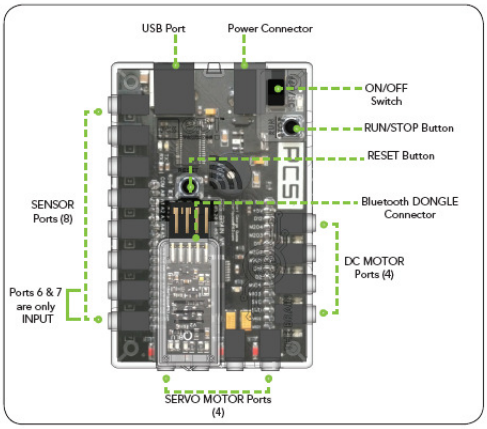
YOUR NAME: UNIT NAME:

QUESTIONS / HYPOTHESES:	
TESTS / EXPERIMENTS PERFORMED:	RESULTS:

- Keeping a journal is helpful for planning your activities and to remember things you did later if you need to do them again.
- It is a normal activity associated with robotics and other scientific activities.

It is an expectation of this class that you will keep a journal with daily updates

The "Brain"



ON/OFF SWITCH
When The Brain switch is turned ON with a power source connected, it can power DC and Servo motors.

Note: The Brain can be powered for programming using the USB cable, however the USB is not adequate voltage to drive motors.

RUN/STOP
Pressing this button runs a program stored in The Brain's temporary memory, or interrupts a program that is running.

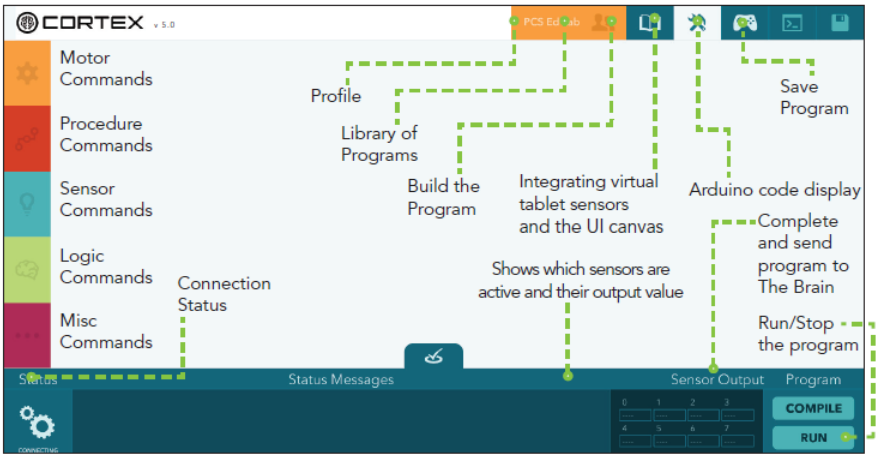
~~RESTART~~ **Reset**
This button resets The Brain. Use this button if the program is not operating properly and the microcontroller needs to be reset.

LIGHTS ON THE BRAIN
The lights that flash on The Brain represent different things. Look at the page 19 for details.

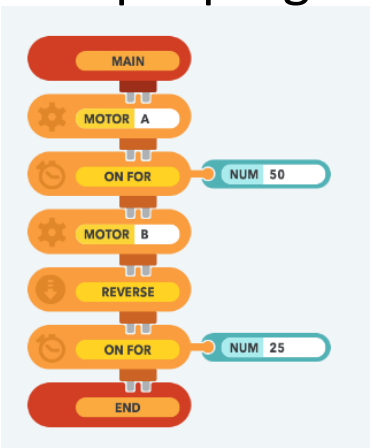
Programming

- Cortex software uses a graphic user interface to create code in the Arduino language
- Cortex also makes Arduino language visible for advanced programming if desired

Cortex software



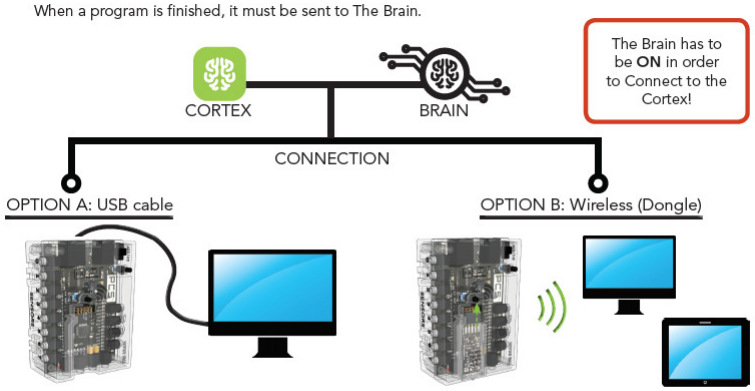
What a simple program looks like



Its easy to build programs by simply dragging graphical pieces and connecting them in the order you want the robot to behave

Uploading software to the Brain

When a program is finished, it must be sent to The Brain.

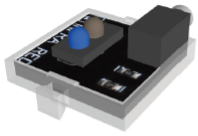


1. Make sure the Bluetooth dongle is removed. The connection does not work with the dongle attached.
2. Connect the USB cable from The Brain to the Desktop.

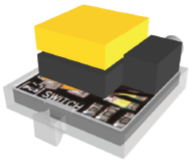
1. Attach the dongle to The Brain. Make sure the black circuit side is facing away from The Brain.
2. Establish a Bluetooth Connection between The Brain and the Desktop/Laptop/Tablet (see next section).

Sensors

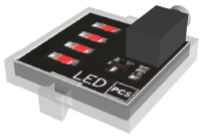
Infrared Sensor



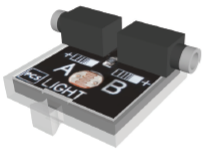
Touch Sensor



LED Sensor

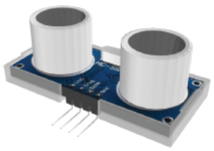


Light Sensor



This sensor detects differences in ambient (surrounding) light conditions. It is a "photoresistor" which increases resistance based on the amount of light it is exposed to. This sensor returns a value between 0 and 1023 based on lighting conditions. The light sensor can be connected to read a low-high range or high-low range.

Ultrasonic Sensor



Use this sensor for object avoidance and measuring distance. It sends out a sound signal and measures the time it takes to receive the signal back after it bounces off an object.

Motors

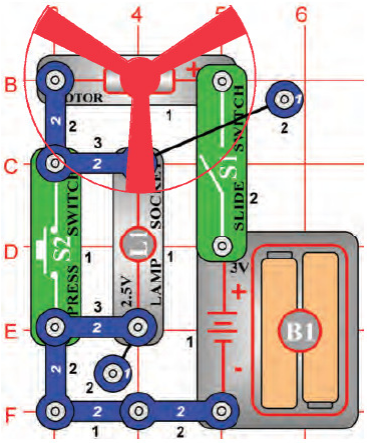
- DC motors
  - Example: Cordless tools like drills
  - Journal entry practice: How do you think you reverse the direction of a motor? How would you you test your hypothesis?
  - Journal entry practice: How do you think you change the speed of a motor? How would you test your hypothesis?

Journal practice

Your name:_____ Unit Name: _____

Questions/Hypothesis	
1. How do you control motor direction? Hypothesis: 2. How do you control motor speed? Hypothesis:	
Tests/Experiments Performed	Results

Hypothesis testing - Two Speed Motor



Build the circuit shown on the left by placing all the parts with a black 1 next to them on the board first. Then, assemble parts marked with a 2. Finally, add the 2-snap wires that are marked for level three.

When you close the slide switch (S1), current flows from the batteries through the slide switch (S1), motor (M1), the lamp (L1), and back to the battery (B1). When the press switch (S2) is closed, the lamp is shorted and motor speed increases.

The principle of removing resistance to increase motor speeds is only one way of changing the speed of the motor. Commercial fans do not use this method because it would produce heat in the resistor and fans are used to cool circuits by moving air over them. Commercial fans change the amount of voltage that is applied to the motor using a transformer or other electronic device.

Show circuits examples of changing polarity and voltage to change direction and speed

DC Motor Learning Points Summary

- Changing polarity (connecting the motor backwards in the circuit changes direction)
- Changing voltage changes speed

Now let us see those concepts being used to control robot motors

- *Show motor test station examples to show how programs can change run time, direction, and speed of DC motors*
  - *Run simple program from laptop to run one motor forward for 5 seconds, then run a second motor backwards to 2.5 seconds.*
  - *Run a program to show how tablet orientation can control a robot to run forward, backwards or turn left or right.*

Other motors

- Servo Motors
  - Used for things like robotic arm movements
- AC motors
  - Fans that plug in wall socket in your home
  - Not discussed in this class

Key learning points today

- STEM careers can lead to high paying jobs
- Lots of students are enjoying building robots and competing
- Journaling and Peer Assisted Reflection is a normal STEM expectation and is required for this class
- The Robot's "Brain" is a computer that has inputs to collect sensor information (like how close it is to an obstacle) and outputs to drive things like motors
- Programing can be very simple using graphical images linked together in a sequence to make an robot behave in a certain way
- Programs are developed and compiled on a laptop or tablet and uploaded to the "brain" via Bluetooth
- DC motors can go forward or reverse based on polarity and they can speed up or down based on voltage
- Servo motors are used for things like arm movements.