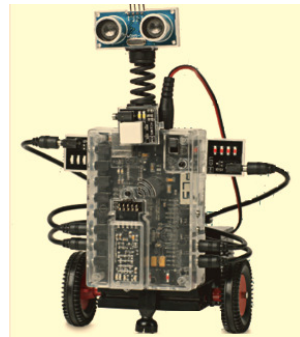# Intro to Robotics Week 5

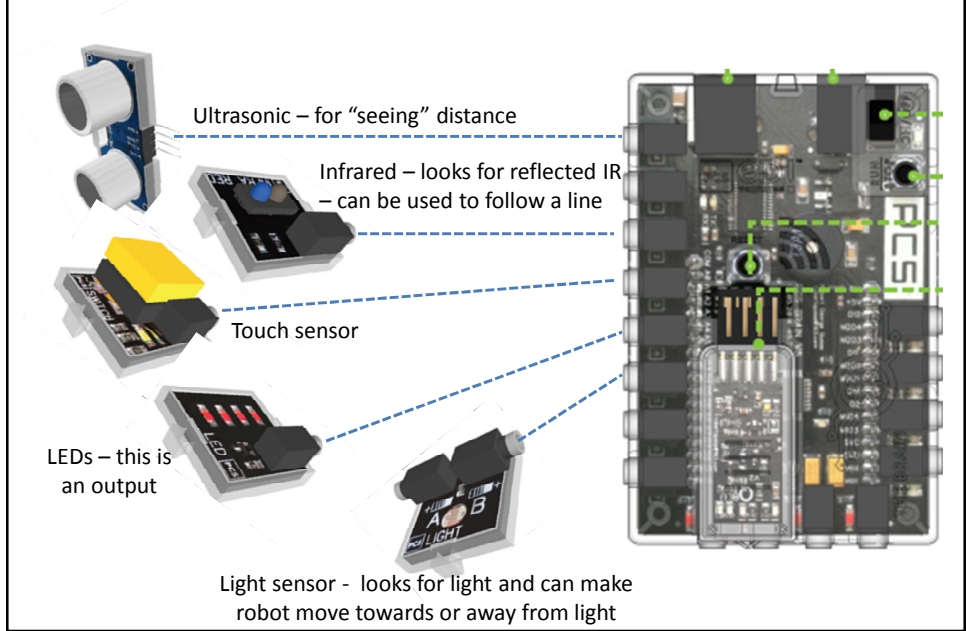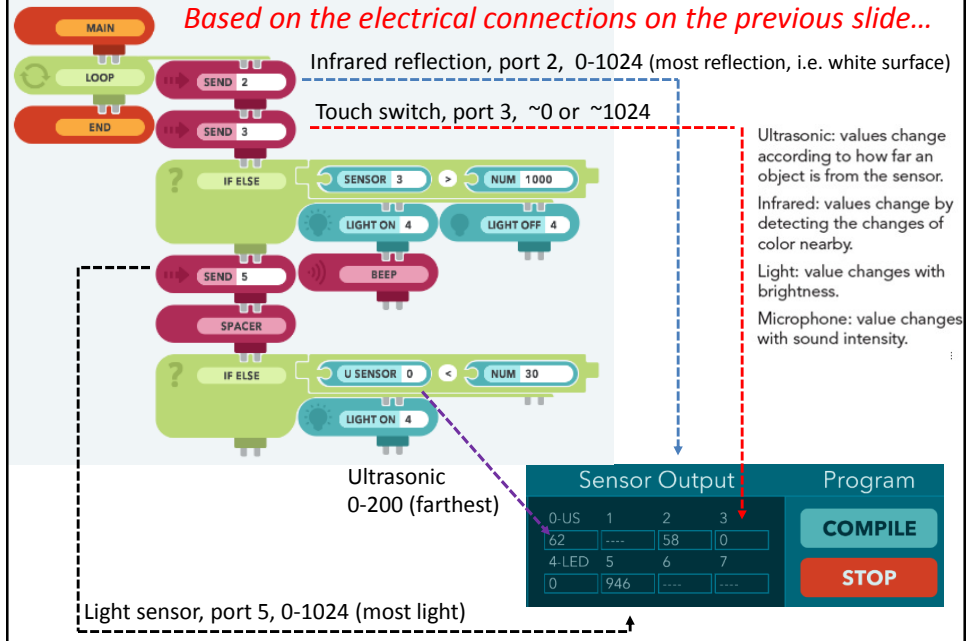## Sensors and Sensor Commands

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# Last week's learning points

- Procedures and calls allow you to use the same code over and over again in a program without retyping it saving you a lot of effort
- The REPEAT and LOOP commands allow you execute the same code many times up to forever
- The IF and IF ELSE allow you to take action on a sensor input such as changing direction.

# Sensors & LEDs

Ultrasonic – for "seeing" distance

Infrared – looks for reflected IR – can be used to follow a line

Touch sensor

LEDs – this is an output

Light sensor - looks for light and can make robot move towards or away from light

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# Reading sensor values

*Based on the electrical connections on the previous slide…*

MAIN

LOOP

END

SEND 2

SEND 3

Infrared reflection, port 2, 0-1024 (most reflection, i.e. white surface)

Touch switch, port 3, ~0 or ~1024

IF ELSE   SENSOR 3 > NUM 1000

LIGHT ON 4   LIGHT OFF 4

SEND 5   BEEP

SPACER

IF ELSE   U SENSOR 0 < NUM 30

LIGHT ON 4

Ultrasonic: values change according to how far an object is from the sensor.

Infrared: values change by detecting the changes of color nearby.

Light: value changes with brightness.

Microphone: value changes with sound intensity.

Ultrasonic 0-200 (farthest)

Light sensor, port 5, 0-1024 (most light)

| Sensor Output | | | | Program |
|---|---|---|---|---|
| 0-US | 1 | 2 | 3 | COMPILE |
| 62 | ---- | 58 | 0 | |
| 4-LED | 5 | 6 | 7 | STOP |
| 0 | 946 | ---- | ---- | |

# How to analyze sensor values

Example of how to analyze infrared sensor values….

1. Connect an infrared sensor to any port on The Brain.
2. Make the connection between The Brain and Cortex.
3. Build the "SEND" program shown above.
4. Press Compile, when it is done uploading, put the front of the sensor facing the white area very close (3 mm). While that is done look at the "SENSOR OUTPUT" on the Cortex.
5. Do the same thing with the black area. See how the values change?

Best distance around 3 millimeters.

**TEST THE SENSOR HERE!**

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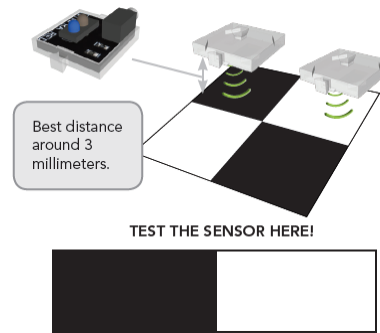
# Sensor Commands

| | |
|---|---|
| LIGHT ON 0 | Turns ON the specified port which powers an LED. |
| LIGHT OFF 0 | Turns OFF the specified port. |
| NUM 0 | Enter a number value. |
| U SENSOR 0 | Represents the value of the ultrasonic sensor on the selected port. |

| | |
|---|---|
| SENSOR 0 | Represents the value of a selected sensor for variables. |
| SENSOR | Represents the value of a selected virtual sensor for variables. |
| SENSOR 0 | Represents the value of a selected sensor for command(s). |
| SENSOR | Represents the value of a selected virtual sensor for command(s). |

## Program to follow a line and stop if something gets in the way
### *Uses two Infrared Sensors and the Ultrasonic Sensor*



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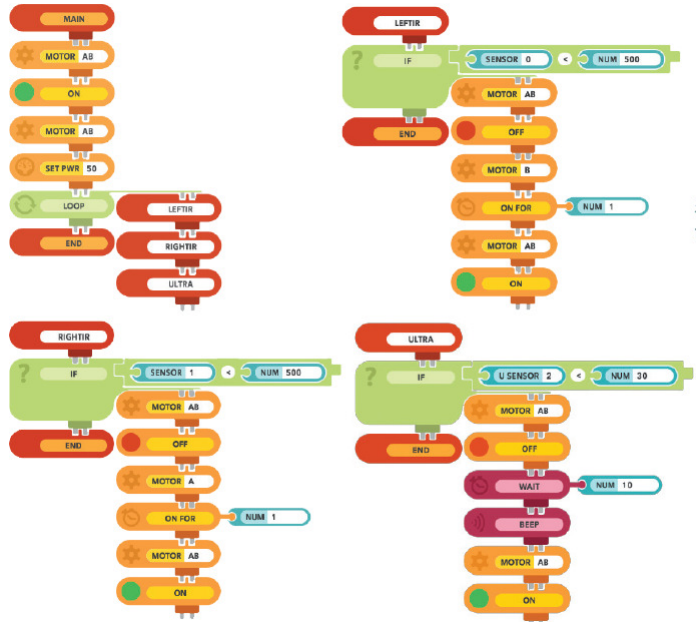
# Today's and next week's Program Challenge

- Write and execute a program that runs a robot around the path shown at least 4 times in 3 minutes or less.
- Bonus points if robot stops if an obstacle is put in its path and robot restarts if object is removed
- Contest will be held beginning 30 minutes into your next week's class
- Today – Develop and write on journal forms your overall strategy to win the challenge assumptions, questions and tests you need to perform to ensure your strategy & program works
- **Winning group(s) gets choice of snacks**



4'
4'
3'
3'
Start – finish line
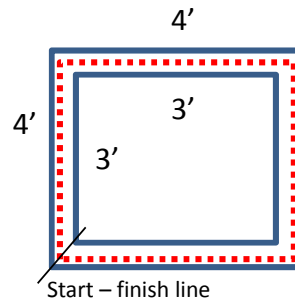
What can be done with proper planning and teamwork:

The two hour house

Pharmadule
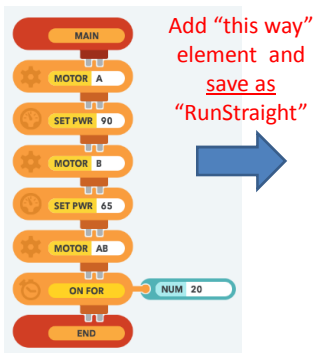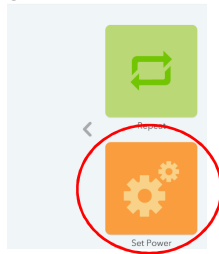
Pharmadule project pics

## Program Challenge Scoring

- Today's strategy and journaling session worth up to 30 points. Elements judged include:
  - Approach to programing and team organization (up to 15 points if written clearly and program should work)
  - List of people on the team and their roles and responsibilities (5 points)
  - Things you need to test to ensure success and how you will test them (10 points)
- Write a program that runs a robot around the path shown at least 4 times in 3 minutes or less. Total possible: 60 points
  - -15 points for each lap less than 4
  - -2 point each time the robot completely crosses either the inside or side boundary marked with blue painter's tape
  - - 1 point for each 10 seconds longer than 3 minutes
- Bonus points - Robot stops if an obstacle is put into its path and restarts if object is removed –20 points

4'

3'

4'    3'

Start – finish line
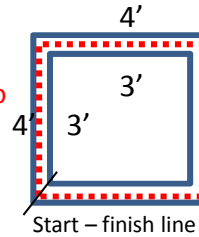
## Program to run robot in a straight line

Your new RunStraight program

Choose "Set power" program from your library in your account
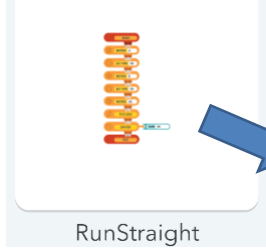
Add "this way" element  and *save as* "RunStraight"

1. *How do you adjust how far the robot goes?*
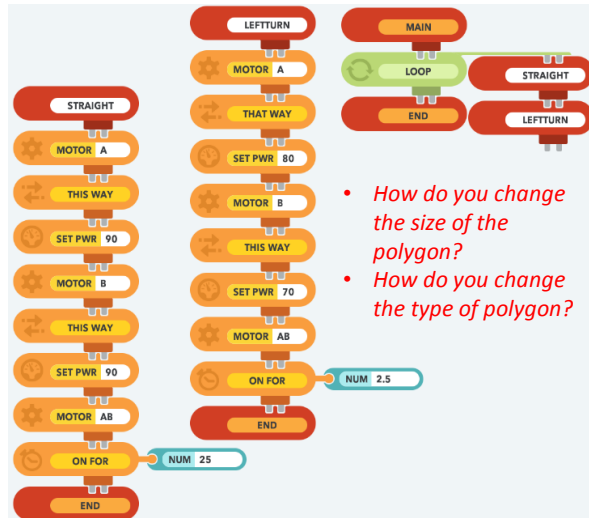2. *How to you adjust if robot veers right or left?*

# Program to run robot in a polygon route many times

Choose your "RunStraight" program from your library in your account

Save as your new "RunPolygon" program

**RunStraight**

Disconnect "main" block and add "procedure" block ther modifications and then add RightTurn procedure and rest of program & save as "RunPolygon"



STRAIGHT — MOTOR A — THIS WAY — SET PWR 90 — MOTOR B — THIS WAY — SET PWR 90 — MOTOR AB — ON FOR — NUM 25 — END

LEFTTURN — MOTOR A — THAT WAY — SET PWR 80 — MOTOR B — THIS WAY — SET PWR 70 — MOTOR AB — ON FOR — NUM 2.5 — END

MAIN — LOOP — STRAIGHT — END — LEFTTURN

- *How do you change the size of the polygon?*
- *How do you change the type of polygon?*

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# Strategy Statement & Journaling

**Strategy to win**
1. Approach to programing (e.g. How will you program to meet the criteria?)
2. How will you organize and perform work to maximize your success?
3. List of people on the team and their roles and responsibilities

*Considerations …..*
1. *Of the programs you have seen or written, what elements would you use in your program to win the competition?*
2. *How due you adjust if robot veers right or left?*
3. *If using Polygon program - How do you change the type of polygon to a square?*
4. *If using Polygon program - How do you change the size of the polygon to operate in the path?*

## Good Luck!

YOUR NAME:                    UNIT NAME:

| QUESTIONS / HYPOTHESES: | |
|---|---|
| TESTS / EXPERIMENTS PERFORMED: | RESULTS: |
| | |