

ROBOFEST
LAWRENCE TECHNOLOGICAL UNIVERSITY

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ROBOFEST

EV3 Software

EV3 Robot

China Workshop

Instructor: Elmer Santos

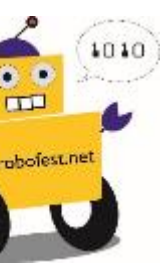
Assistants: Daniel, Mark and Zhen

Lawrence Technological University
Computer Science



Schedule

- 9:30am ~ 12pm: EV3 Lego robot workshop
(Each student must bring a laptop and EV3 kit)
- 12pm ~ 1pm: Lunch
- 1pm ~ 2:30pm: Lego robot team projects (2 hours)
- 2:30pm ~ 3:30pm: Team presentations in English (1 hour) - Open to parents/coaches for video



Agenda

9:30-11:00 Basics

Overview- Human/Robot interaction

Move blocks, Gears, Touch Sensor, Color Sensor

11:00-11:30 Mechanical Devices

4 bar linkage, Turntable, Conveyor Belt

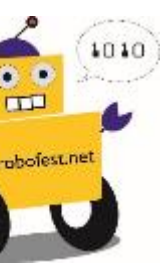
11:30-11:50 More Sensors: Ultrasonic, Proximity

11:50-12:00 Introduction of team project

12:00-1:00 LUNCH

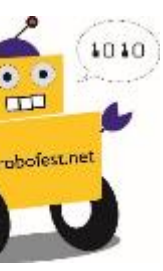
1:00 -2:30 Lego Team Projects (work in groups)

2:30-3:30 Team presentations



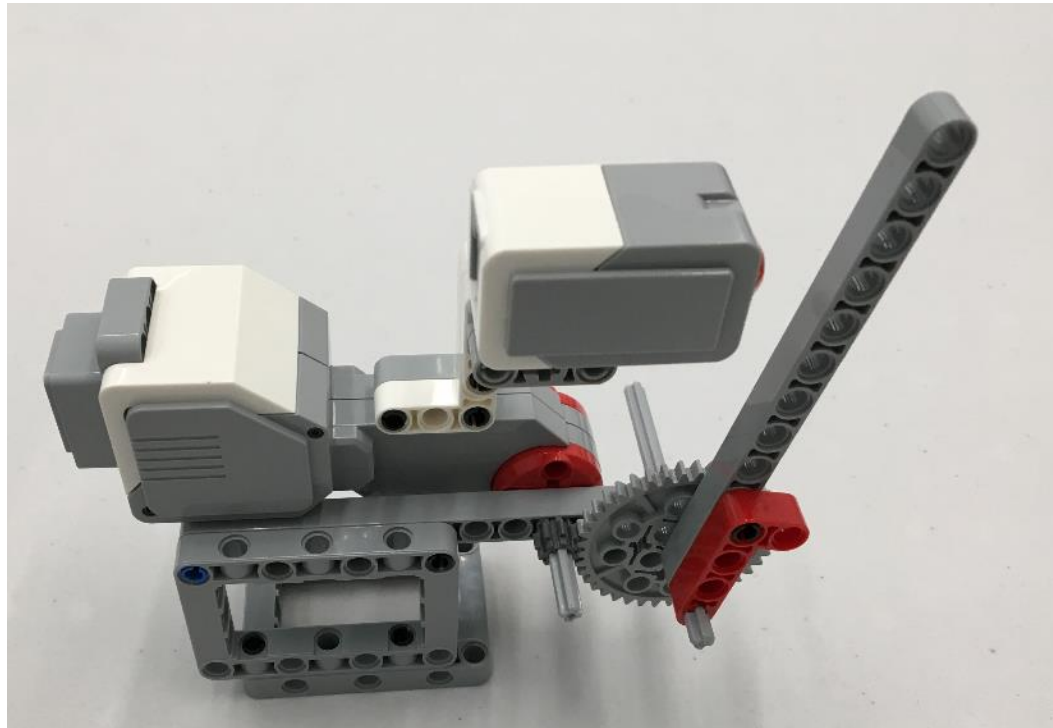
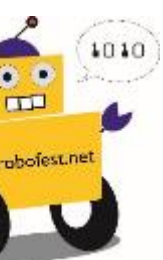
Overview

- Learn about programming motors and sensors
- Learn about mechanisms
- Learn how to program a math sequence
- Work in teams to build a demonstration project



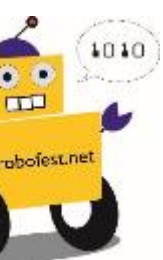
Human <-> Robot Interactions (*)

- Waving Hands – Sonar Sensor
- Clap/Knock – Sound Sensor
- Double Clap/Knock – Sound sensor
- Flash Light – Light Sensor
- Color Blocks – Color Sensor
- Gesture – On-board camera
- ...

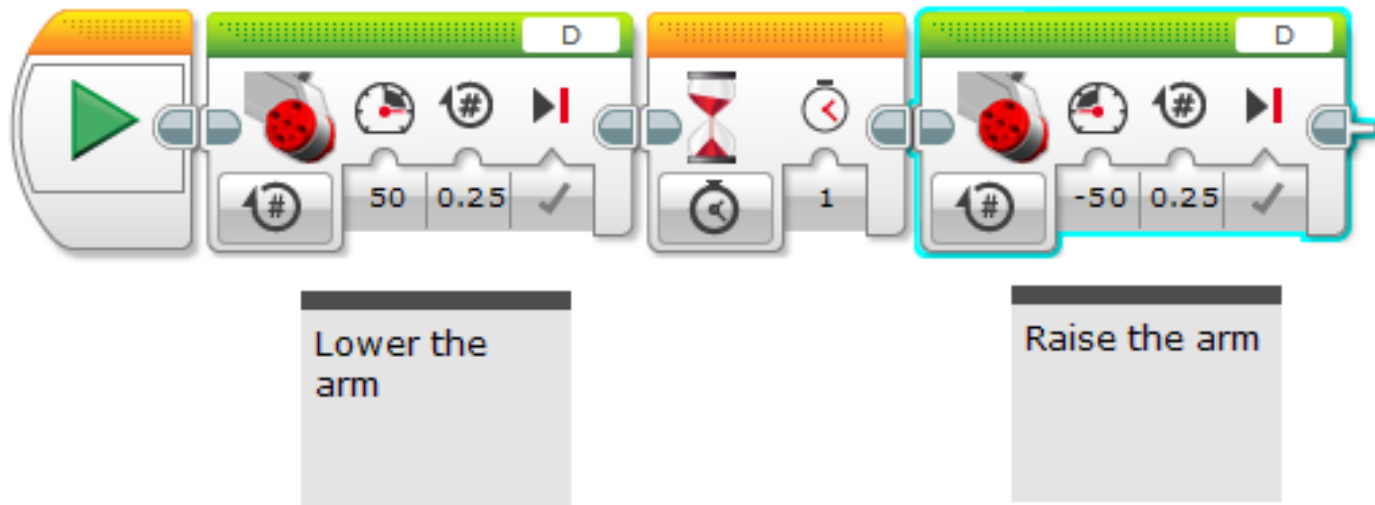


Motor Movement

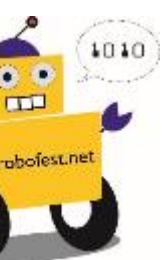
USING MOVE BLOCKS



Move Arm using Move Block

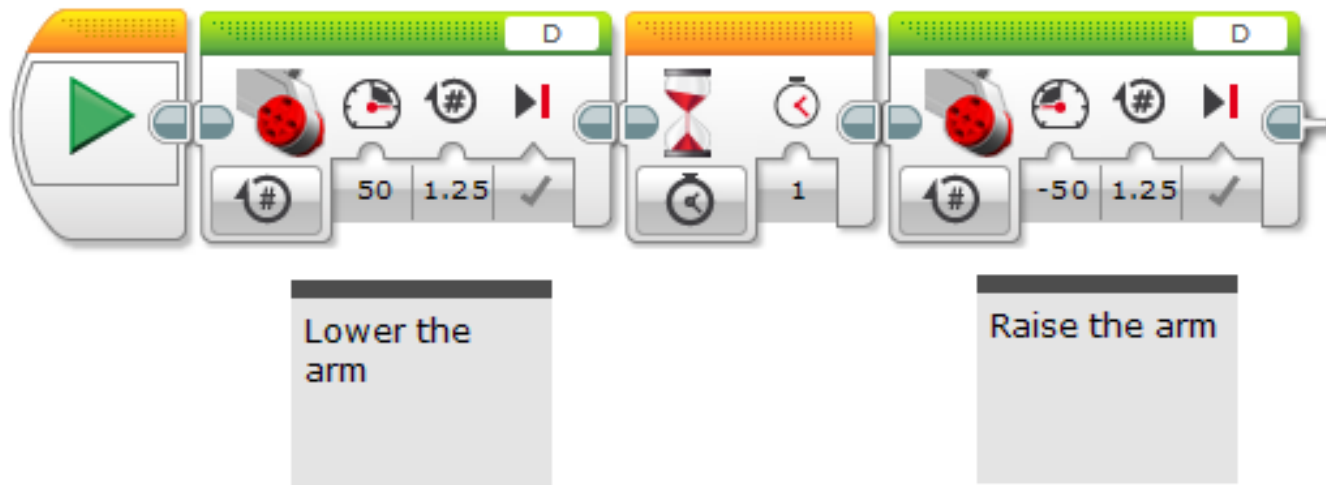


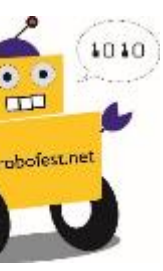
Try using “degree” mode



Add a Gear Reduction

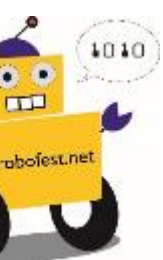
- What program changes are needed?



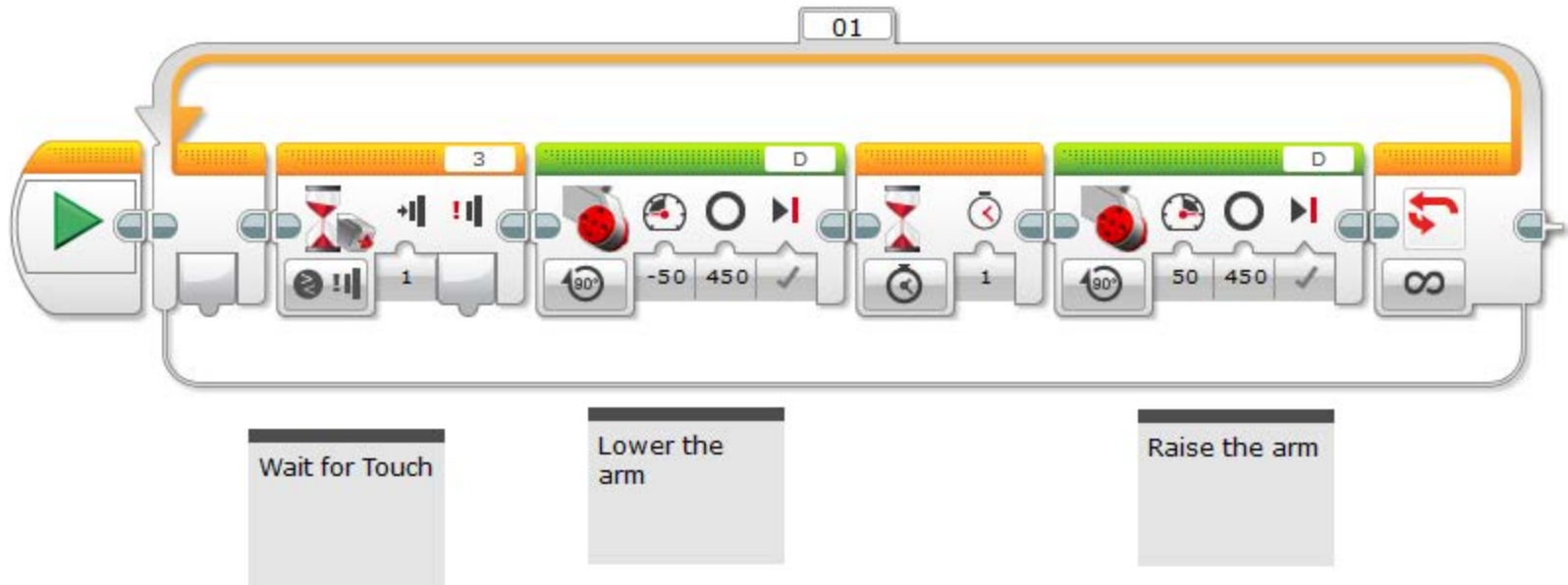


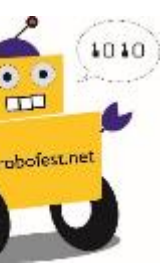
Motor Movement

USING SENSORS



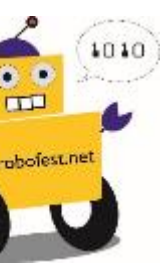
Use a Touch Sensor to Start





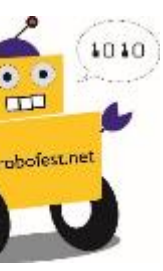
Use a Touch Sensor to Stop





COLOR SENSORS

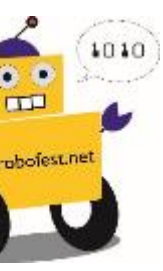
**USING SWITCHES, SOUNDS, AND
DISPLAYS**



Color/Light Sensors

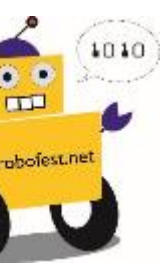
- Multiple Modes
 - Reflected Light
 - Measures % brightness
 - Color
 - Senses different colors
 - Part Presence





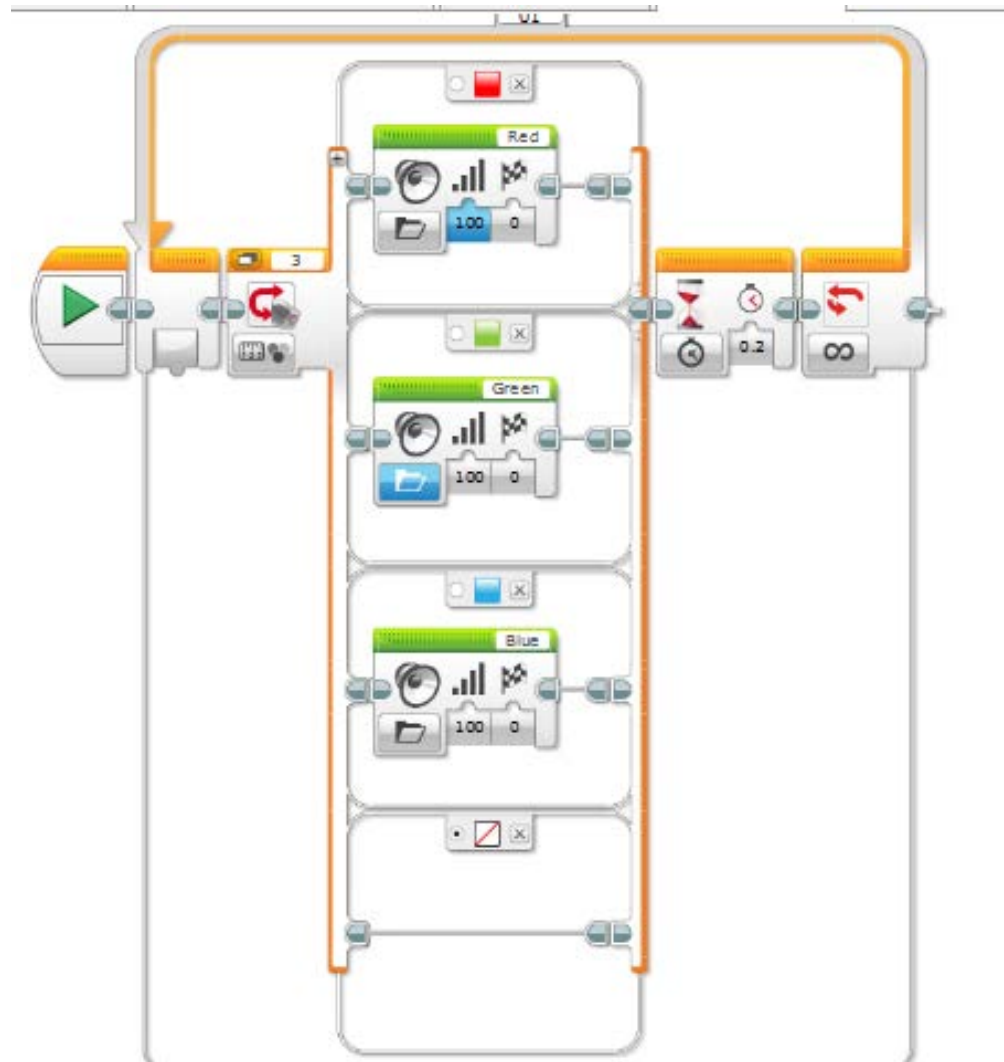
Color Sensor

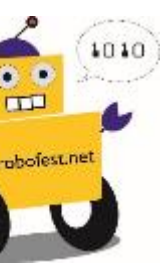
- In Color mode, the Color Sensor will output a number:
0 = No Color
1 = Black
2 = Blue
3 = Green
4 = Yellow
5 = Red
6 = White
7 = Brown



Color Sensor Example

- Detect a colored block
- Say the name of the color





Use the Display

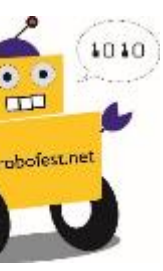
- Displays Text, Shapes, or Image
 - Messages
 - Show data
- Display the name of the color for each case in the previous exercise



Enter
Message
Here

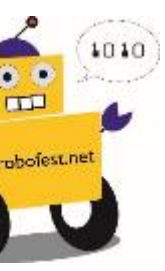
Text,
Shape or
Image

Position of
message on
Screen



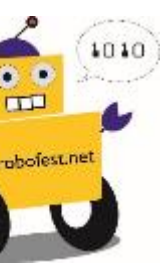
An example of using Math

USING GEOMETRIC PROGRESSION



Can you guess the next number?

8, 4, 2, 1,

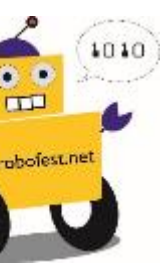


Geometric Sequence

- 8, 4, 2, 1, $\frac{1}{2}$, $\frac{1}{4}$, ...
- Initial value $a = 8$
- Ratio $r = \frac{1}{2}$

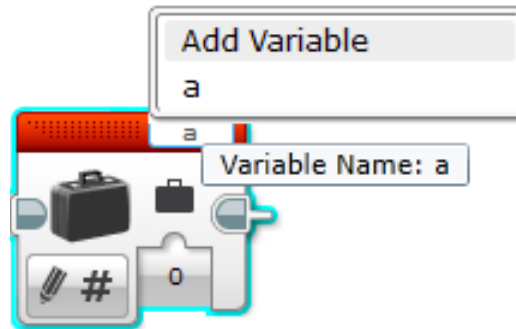
$$a_n = a \cdot r^{n-1}$$

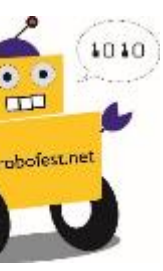
$$a_n = r \cdot a_{n-1} \text{ for every integer } n \geq 1$$



Creating a variable for the 'pause' time

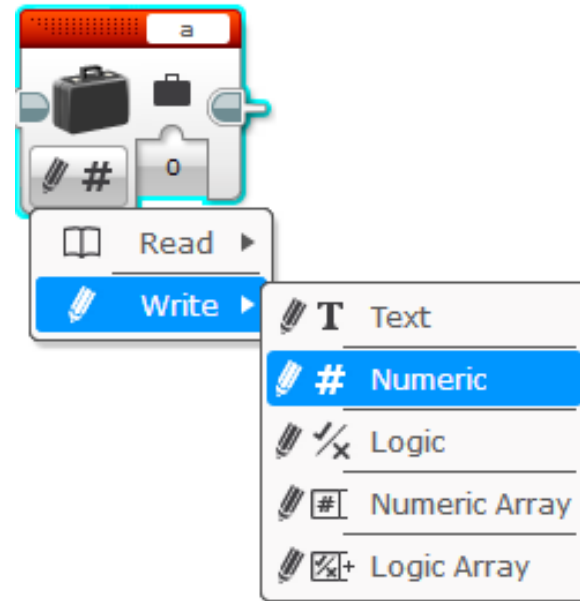
- go to the Edit menu and get a “Variable” block from the “Data Operations” menu
- Enter the variable name in the upper right

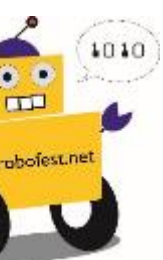




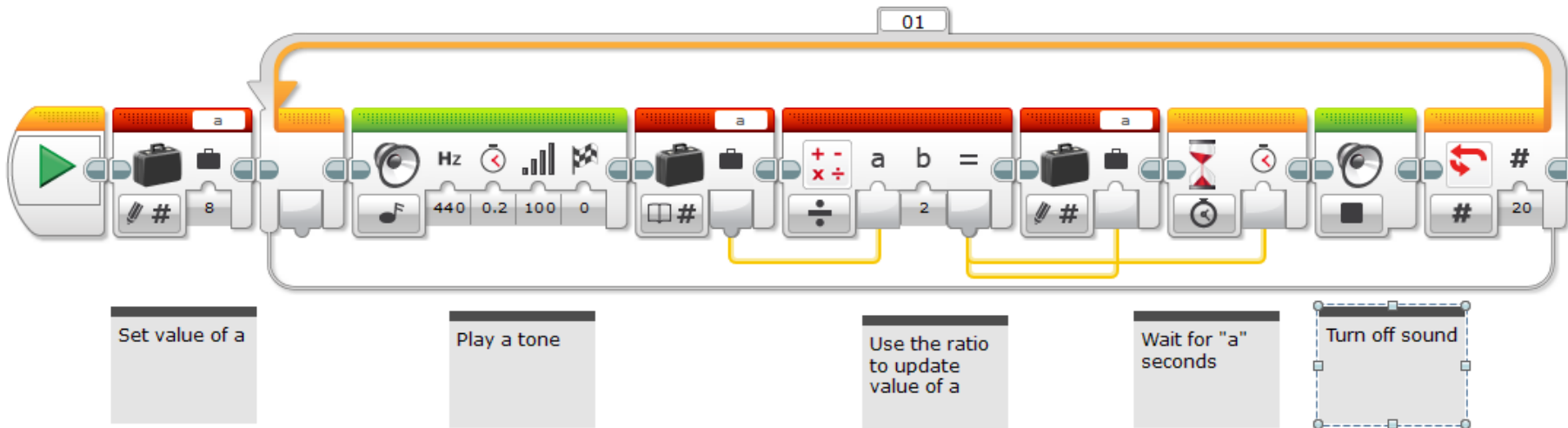
Using the variable

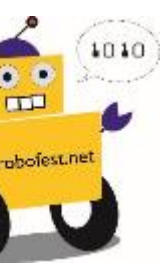
- Two modes:
 - ✓ Read
 - ✓ Write
- Select “write” and “numeric”





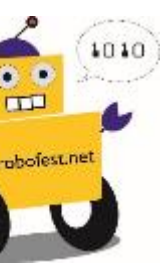
Play a tone using a geometric sequence duration ($r = 1/2$)





More Mechanisms

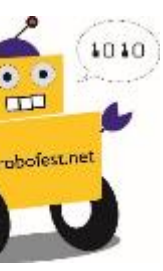
**4 BAR LINKAGE, TURNTABLE, AND
CONVEYOR BELT**



4 Bar Linkage

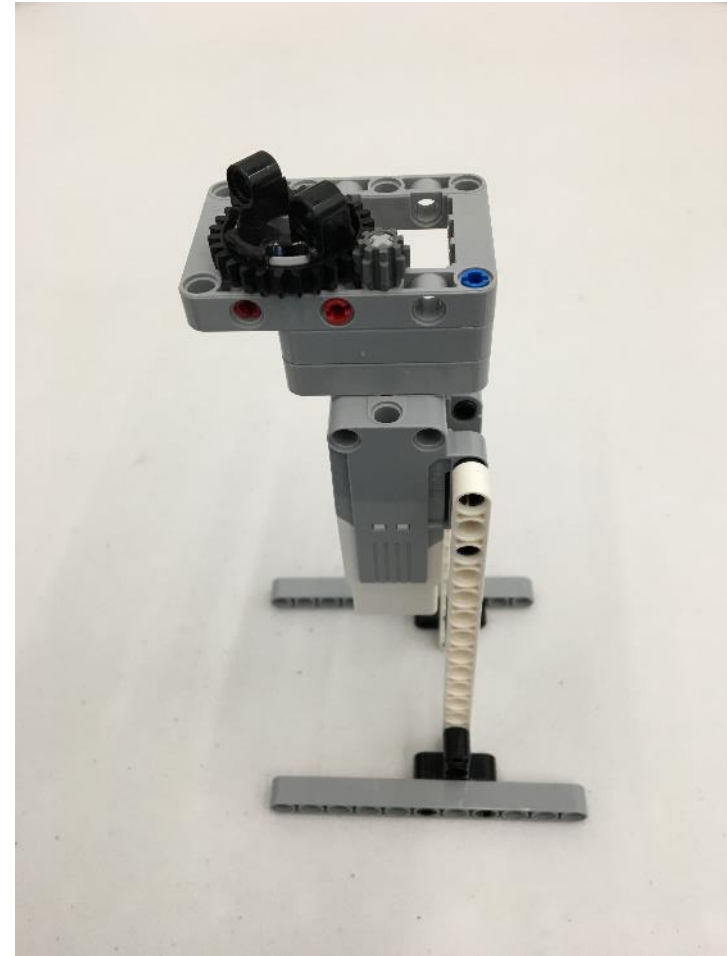
- Produces Parallel Motion
- Build a 4 bar mechanism
- Attach a motor
- Can you program it?





Small Turntable

- Build a small turntable mechanism
- Can you program it?
- Add a sensor to make it stop at a specific position

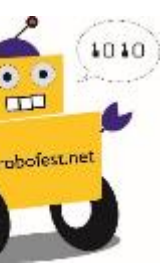




Tank Tracks

- Build a Conveyor

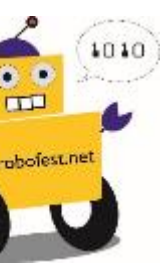




Ultrasonic Sensor

- Can be used to detect objects
- Can be used to detect position or presence
- Program the conveyor belt to detect when an object reaches the end of the conveyor belt

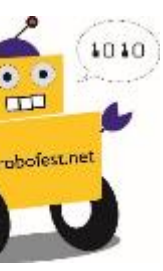




Infrared Sensor

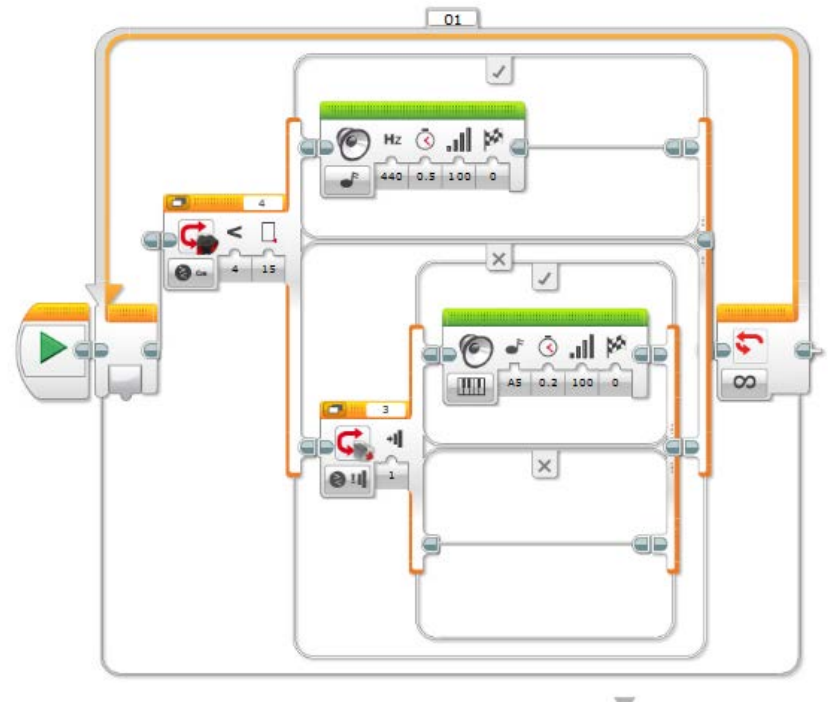
- Similar to Ultrasonic Sensor
- Shorter range than Ultrasonic sensor
- Use the Infrared sensor in place of the Ultrasonic

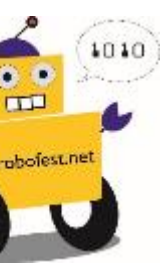




Nesting Switches

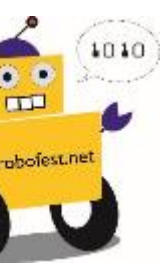
- Used to look for more than one condition at time
- Write a Program that plays different sounds depending on if the Ultra Sound Sensor is activated or the Touch Sensor is touched





Robot <-> Robot Interactions

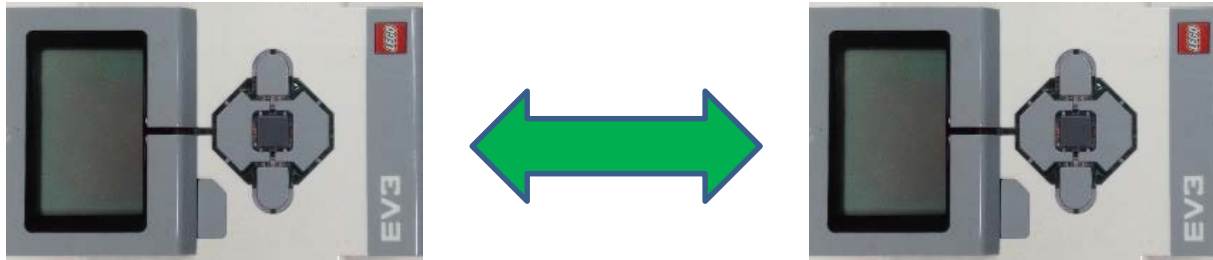
- Touch
- Light/Color sensor; special color jersey
- Ultrasonic
- Proximity
- Bluetooth or ZigBee
- On-board camera – Robot gesture / visible signal
- ...

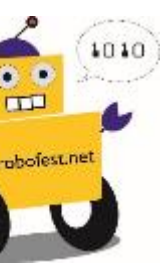


Robot \leftrightarrow Robot Interaction

Movement

SENSOR





Project Assignment

- Form teams of 3 or 4
- Create a project
 - 3 EV3 Brains

