INTERMEDIATE PROGRAMMING LESSON

EV3 LESSONS

INFRARED SENSOR

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EV3 CLASSROOM LESSON
BY EV3LESSONS.COM

Lesson Objectives

1. Learn how to use an Infrared Sensor
2. Learn to make a remote control system and a program that follows the beacon.
3. Learn to use the Infrared Sensor in all three major modes
4. Learn the limitations of the Infrared Sensor

Prerequisites: Switches, Loops, Compare blocks, and Math blocks

What does the Infrared Sensor do?

Measures proximity to beacon or object

Measures the angle of the beacon relative to the sensor

Measures which button is pressed on remote.

Beacon/remote can be set to 1 of 4 channels. Infrared sensor code must specify which channel to use. This allows you to use multiple remotes in the same room

Infrared Sensor

Beacon/Remote

Modes

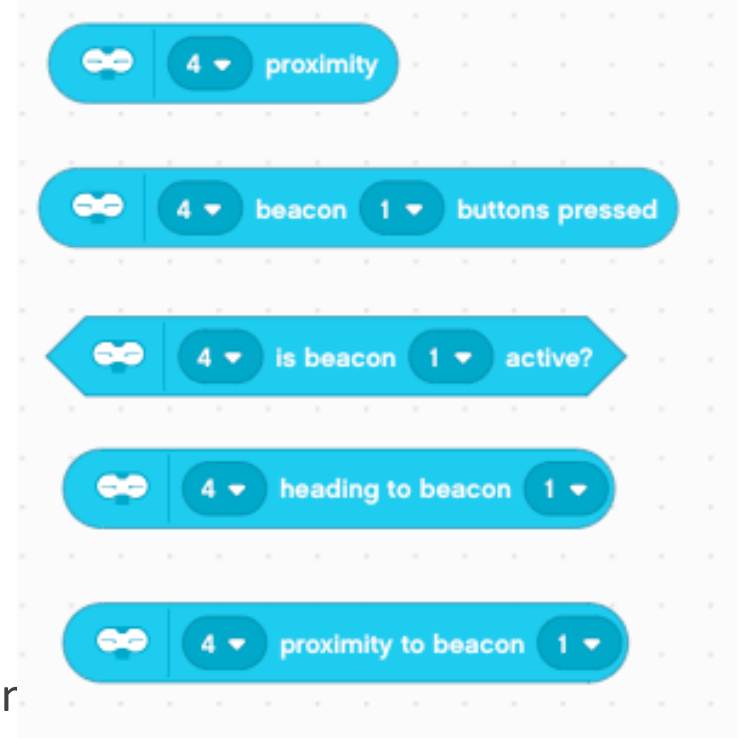
Works up to about 70cm away (or 100 proximity units)

Proximity Mode

- Proximity to object (uses infrared reflection and is in % reflectance)

Beacon Mode

- Beacon buttons pressed
- Is the beacon active?
- Heading [angle] to beacon
- Proximity to beacon



Beacon # is the channel of the remote

The first input is the port the sensor is connected to

The Infrared Sensor block can be found in the blue ser tab

Challenges

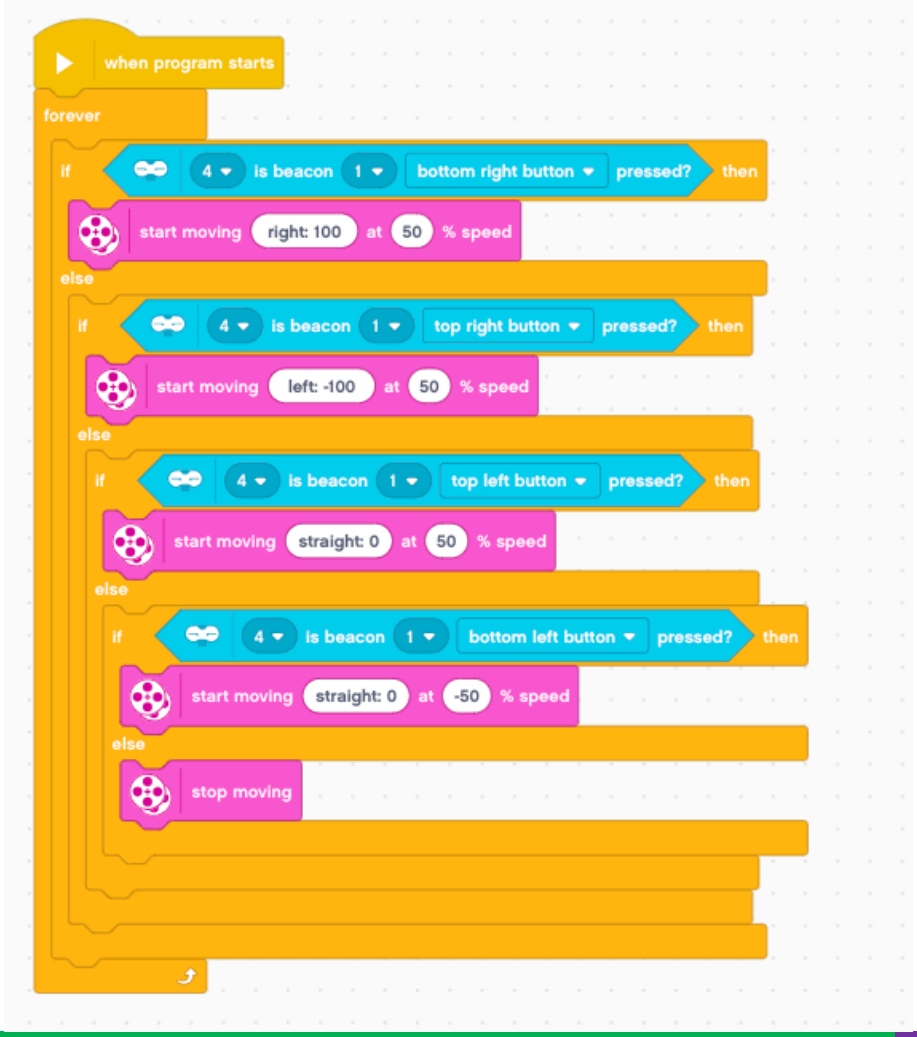
To learn how to use the Infrared Sensor you will complete three challenges:

- Challenge 1: Create a remote control for your robot that does a different action based on which button you press on the Remote
- Challenge 2: Proportional Dog Follower: The robot should move to wherever the Beacon is using proximity and heading
- Challenge 3: Test how accurate the Infrared Sensor is for measuring distances

Pseudocode/Hints

Challenge	Hint/Pseudocode
Remote Control	Run different actions based on which button(s) are pressed on channel 1
Proportional Dog Follower	If the robot is <10 proximity from the beacon move backward If the robot is >10 proximity from the beacon move forward Use proportional control to adjust the steering base on the "heading" of the beacon *Note: Proportional Control is covered in an Advanced Lesson on EV3Lessons.com. Please refer to this lesson.*
Accuracy of Proximity	Measure distance using ultrasonic and measure proximity using infrared (use Port View on brick). Compare measurements for different distances to different surfaces.

Solution: Remote Control

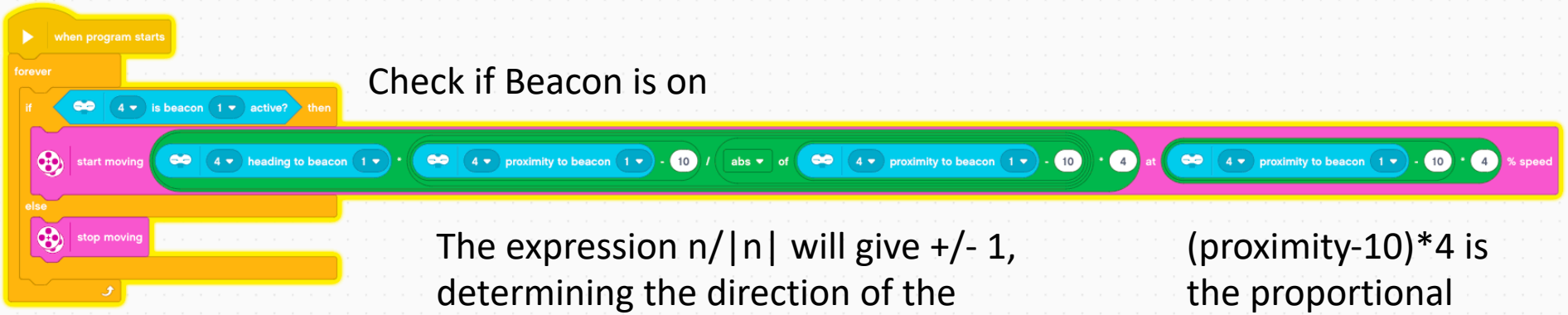


Make sure to set your beacon remote to channel 1 using the slider button on beacon

In a forever loop, use nested switches to determine which button is pressed. Run a different action for each button. In the example on the left, the robot will move Right, Left, Forward or Backward depending upon what button is pressed.

If no defined button is pressed, stop motors.

Solution: Dog Follower (Advanced)



Check if Beacon is on

If beacon is off, do not move

The expression n/|n| will give +/- 1, determining the direction of the movement (|n| means absolute value of n, or the number without a + or -). The steering must be swapped based on the direction of movement. Multiplying by the heading, and a proportional constant of 4, gives us the desired steering.

(proximity-10)*4 is the proportional calculation to stay 10% proximity away from the beacon. This is the speed calculation.

For a simple, non proportional version, try adapting the Ultrasonic Dog Follower in our beginner lessons.

Challenge 3: Compare Sensors

Surface	Actual Distance to Surface	Ultrasonic Measurement	Infrared Measurement
Aluminium Foil	10CM		
Wooden Table	10CM		
Black Paper	10 CM		
Glass	10 CM		
White Paper	10 CM		
Beacon	10 CM		

Instructions:

1) Hold the each sensor 10CM away from the material and check the sensor readings on Port View

2) Pick surfaces of varying reflectivity to try

Lesson:

The Infrared Sensor's reading are based on the intensity of the reflected IR light from the object. It will not be as accurate as an ultrasonic sensor in measuring how far away an object is. Try different distances next. The Beacon should be more accurate as it produces an infrared signal.

Discussion Guide and Next Steps

What modes does the Infrared sensor have?

- Ans: Proximity, Beacon and Remote

Can the Infrared sensor measure distance?

- Yes, but not accurately because it is based on the reflected light intensity. So, it is going to vary based on the material the object is made of.

Next Steps:

Read the Advanced Lesson on Proportional Control.

Credits

- This tutorial was created by Sanjay Seshan and Arvind Seshan
- More lessons at www.ev3lessons.com