Teacher Notes - Light Sensors

Description of the Activity
In this unit students will learn how to program light sensors for their robots. They will learn another application of threshold values and then take that information and apply that to several engineering challenges.

Activity Summary: Students will be able to...
• Describe how a light sensor works.
• Calculate the threshold value for a light sensor.
• Program their robot so that it will travel until the light sensor sees a dark value.
• Complete an engineering challenge of the teacher’s choice to reinforce the above concepts.

Prerequisites
- Complete the Touch Sensor Unit
The following handouts may be used or students may access the reading materials through the LMS
  - Building Instructions for the Ultrasonic Sensor
  - Robo500 Level 3 Challenge
  - RoboMower Level 2
  - Calculating Thresholds Handout
  - Random Numbers Handout
  - Ultrasonic Sensor Quiz

Central Concepts
  Behavior Based Programming
  Boolean Operators

Approximate Class Time
  2 weeks

Note to the Teacher
The light sensor has the possibility of being affected by ambient light in the room. You should setup your sensor so the front of the sensor is shielded from any room light. Also, to assist with keeping light out, you should also put your light sensor as close to the surface as possible. The best robot design has the light sensor very close to the ground.

Because the reflective light on the light sensor is red, the light sensor will see red-colored surfaces as “white” because all of the red light will be reflected back to the sensor.

By this lesson students should be getting pretty comfortable with the basic programming that they’ve learned up until now.

Reinforce breaking the robot’s behaviors into small parts; behavior based programming.
Classroom Implementation
1. Watch the “Light Sensor” video and discuss the content in the video.
2. Attach a light sensor to the robot if one is not already attached. Discuss how ambient light can cause the light sensor to give inaccurate readings.
3. Watch the “Thresholds 201” and discuss the video’s content.
4. Give the student the handout or assign students to review the “Thresholds” handout from the LMS.
5. Watch the “Wait for Dark” video. Review how the while loop is used in this program to control when the robot stops.
6. Assign students to complete one of the following challenges:
   - The Robo500 Level 4
   - TableBot Challenge Level 2
   - Line Runner Challenge Level 1
   - Firefly Challenge Level 1
   - The Minesweeper Challenge
7. Have students take the Forward Until Dark Quiz

Note: Remind student to apply proper comments and whitespace to all of their programs.

The next couple of pages gives a short description of the resources found in the LMS.

Sensing - Light Sensor Resources

The Forward Until Dark Lesson Set introduces students to how the light sensor works, how to troubleshoot programs that use the light sensor, and how to calculate threshold values for light sensors. The Lesson Set has the following resources:

The Light Sensor Video - The light sensor video reviews how the touch and ultrasonic sensors work and then describes how the LEGO light sensor works. The video also describes things to consider to optimize how the sensor works.

The Thresholds 201 Video - This lesson describes how to calculate thresholds for the light sensor. It also demonstrates the physical steps that a programmer needs to do to calculate a light sensor threshold value.

The Wait for Dark Video - This lesson begins with a prior program, then adapts the program to use the light sensor. Students will learn how to configure the Motors and Setup Configuration menu for the light sensor, and then are given directions that allow them to complete the program.

The Threshold and Random Numbers Reference Pages - These handouts are the same handouts used in the previous lesson and are useful to students still learning these foundational programming concepts.

The Forward Until Dark Printable PDF - This document is a printed version of the three video lessons in the Forward Until Dark Lesson Set.

The Programming Challenges - There are five programming challenges with this lesson: The Robo500 Challenge (Level4), the Table Bot Challenge (Level 2), the Line Runner Challenge (Level1), the Minesweeper Challenge, and the Firefly Challenge (Level1). All students may not complete all programming challenges.

Forward Until Dark Lesson Set Quiz - A quiz to check student’s understanding.