Doing an Assignment

The Light Sensor

NSF Workshop

Pam Lawhead
Assignment:
The Light Sensor
The Sensors

Normally, there are three types of sensors used programming the RCX, and they are:

- Touch Sensor
- Light Sensor
- Rotation Sensor

This assignment will focus on the Light sensor.
Overview

The purpose of this assignment is to give the student experience in Java event programming involving light sensors. It will give students more chances to practice using the RCX-Lejos LCD screen control, the If statement, and additional loop control skills.
The Lego Mindstorm with Light and Touch Sensor

- The sensor illuminates whatever is in front of it with an LED (light emitting diode) and records the amount of light it gets back with a photo-sensitive device.
- This photo-sensitive device returns a signal that is amplified and digitized (transformed into a number).
- The range of values for the signal is 0 (dark) to 100 (bright).
- The value measured will vary with the surface it examines, the distance separating it, and the ambient light (environment).
The Lego Mindstorm with Light Sensor

- The LEGO Mindstorm’s light sensor has a range of about 3 inches.
- In Java, the sensor can measure the percentage of light received by the photosensitive device.
- The RCX displays a lower percentage of light on black colors and a higher percentage on white colors.
- The robot can follow a path by reacting to light percentages.
Problem Statement

- Write a small Java program to demonstrate how the light sensor works. There are three different colors used on the background surface: black, green, and white. Through the program, the LCD should show the percentage of light corresponding to different colors on the background. When the light sensor is on white, there should be a range of numbers, on green another, and finally on black another.

- **Battery power and ambient light will affect how the machine behaves.**

- Using data gained from above experiment, write a Java program to make an RCX, equipped with one light sensor and at least two wheels, navigate on flat surfaces and follow the black line.
Laboratory Preparation

- How does this program get input data or receive data in this lab? What is the difference from the previous labs?
- How many variables do you plan to use? And what data types are the variables?
- Write a small method called LeftAndRight that makes the RCX turn left or turn right based on some value that it receives.
- Write the program outline for the testing light sensor assignment.
- Write the method headers for this assignment. Once this is done write the full code. Bring this code to the lab.
Robot Needed:
- RCX brick, 2 motors, 2 or 4 wheels, and 1 light sensor.

Lejos classes and method needed:
- Motor: setPower (int aPower), forward(), backward(), stop()
- Sensor: activate(), passivate(), int readPercentage() (for light sensor)
- LCD: showNumber(int value)

Other equipment:
- Track
Solution Strategy

- Fix the light sensor at a 90 degree angle to surface. Allow no more than 3 inches from sensors to surface.
- The key to functionality is using the method readPercentage() of the class Sensor,
- Sensor.S1.readPercentage() returns an integer value representing the percentage of light received.
- The shape of the trace is ellipsoid. Set one Motor to stop and allow the other Motor to move forward, causing the RCX to turn left or right.
- When executing, watch direction RCX is moving. If the program allows the RCX to turn left, keep the left side of the RCX inside of the black line. Otherwise, place right side on the inside.
Testing

- Stand in different places when checking the color percentages.
- Start Robot on Green, on White, on Black
- What happens if you reverse directions?
- Could you adjust if you had to change directions? How?
Submissions

- Answers to Pre-Lab questions
- Brief description of expectations before lab
- Discussion of how time was spent in lab
- How long did lab take, including Pre-Lab preparation?
- A list of the problems encountered writing code for lab.
- A list of the problems had running and using lab.
- Names and roles of any collaborators
- Email program after demonstration