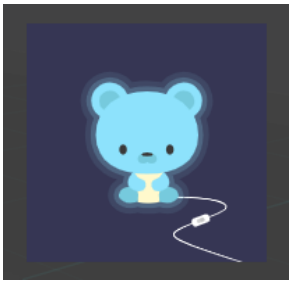
Unit 3: Using Inputs and Outputs



Mission 12: Night Light

Intro and Discussion Points:

In this project, students use an external light sensor to detect ambient light, and program the CodeX's LCD display to act as a "nightlight."

Extension

Optical Feedback!

Using your first ON/OFF version of the nightlight project, try placing the photocell near the LCD display, so that when the display is ON it shines right at the photocell. Make sure the room is relatively dark…

- Dark ⟶ LCD ON ⟶ Light ⟶ LCD OFF ⟶ Dark ⟶ LCD ON ⟶ Light ⟶ … where will it end??
- If you've ever heard speakers squeal when a microphone gets too close to them, you know about *audio feedback*. This is the optical version!! (it also shows how fast the CodeX is sampling the ADC and controlling the LCDs)

CodeX Lesson Plans

UNIT 3: Using Inputs and Outputs	MISSION 12: Night Light	# DAYS: 2
UNIT GOALS: Students will use the CodeX sensors to create programs with real-world applications.	**ADDITIONAL MATERIALS:** ● Photocell ● 2 alligator clips	**VOCABULARY:** ● Analog ● Digital ● ADC

FOCUS CSTA STANDARDS: 2-CS-02, 2-AP-17, 3A-DA-09, 3A-DA-11

LEARNING TARGETS:

- I can apply input and output values to a program.
- I can explain the differences between analog and digital I/O.
- I can explain the differences between reading and writing I/O.
- I can use variables to calculate and convert measurements.

SUCCESS CRITERIA:

Create **two** versions of the Night Light:

- ❑ **1 - Simple on/off control:** Light turns ON when sensor crosses a pre-set "dark threshold."
- ❑ **2 - Variable dimming:** The darker it gets, the brighter it shines!

KEY CONCEPTS:

- The photocell helps convert light level into an electrical voltage level.
- Analog means infinite variation from dark to light, cold to hot, and so on. The CodeX's *analog to digital converter* (ADC) gives a digital approximation of the photocell's analog reading.
- Create your own `Image` object, using the `fill()` function to set all pixels to a given brightness level.
- I/O pins can be read with `read_digital()` and `read_analog()`functions.

DISCUSS REAL WORLD APPLICATIONS:

Welcome to Smart Lighting!

This project has introduced students to an area with lots of potential for improving the world! Light Sensors and LCD lights controlled with code can reduce energy consumed and make lighting more awesome!

This code can enable and enhance many real-world applications:

- Outdoor Lighting
  - Street Lights, Parking lots, Home lighting
- Stadium Lights
  - Even controlling the light color so it looks better on camera
- Indoor Lighting
  - Sensing daylight from windows and skylights is calLCD Daylight Harvesting - it saves energy!
  - That's exactly what your last NightLight code was doing!

ASSESSMENT STRATEGIES:

Remix suggestions (set aside 0.5-1.5 periods to complete):

- The photocell is very sensitive. Write code that counts up whenever the sensed value changes by a small amount.
  - Can you detect how many times someone has walked by the sensor?
  - Detect any object breaking a beam of light shining on the photocell!
- Send a radio message when the light goes ON or OFF. (More on this later in the Radio Project!)
  - Finally you can test if the light in the fridge goes OFF when the door is shut!

TEACHER NOTES:

Always refer to **Appendix A:** if you get stuck. It has the "Answer Keys" for you.