FIRIA LABS

MISSION 11: Night Light		Time: 50 minutes
Overview: In this project students will create **a smart night light** that turns on when the room gets dark. They will use the CodeX's built-in light sensor to detect ambient light and the pixels as a night light! Using a darkness threshold and some math, students will detect the amount of darkness and adjust the brightness of the pixels as a nightlight.		**Objectives:** ● I can apply input and output values to a program. ● I can explain the differences between analog and digital I/O. ● I can use variables to calculate and convert measurements.
Standards: **2-AP-12** Design and iteratively develop programs that combine control structures, including nested loops and compound conditionals. **3A-AP-17** Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects. **3A-IC-26** Demonstrate ways a given algorithm applies to problems across disciplines.	**CSP Framework:** **Computational Thinking Practices:** 3.B Use abstraction to manage complexity in a program. 4.C Identify and correct errors in algorithms and programs, including error discovery through testing. 6.A Collaborate in the development of solutions.	**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. ● I/O pins can be read with `read_digital()` and `read_analog()`functions.
Preparation: **Make a copy** of the assignment or put it in the LMS. **Prepare** formative assessments	**Links:** ● Assignment ● Daily reflection form ● Analog & Digital (from mission 5) ● Mission 12 solution ● Mission 12 with functions	**Agenda:** ● Warm-up (5 minutes) ● Mission 12 (30 minutes) ● Extensions (10 minutes) ● Wrap-up (5 minutes)

Vocabulary: Review from Mission 5

- **Analog:** Infinite variation in something, like hot to cold or light to dark; smooth and continuous signals that represent a quantity, like sound waves
- **Digital:** A numerical representation of an analog signal, represented in increments
- **ADC**: analog to digital conversion

Assessment:

- Daily reflection journal or form
- Completion of assignment and mission
- Exit ticket on vocabulary
- Group review on vocabulary

Teaching Guide

The actual coding part of this Mission is about one normal class period. The extension for this mission is fairly easy and doesn't take much time. Also encourage the students to create a function for extra practice. The challenge is purely optional and is included only in case you have students working extremely quickly and they need a challenge so they don't get ahead of the class. The challenge will require an if statement with several branches. It could also be a function.

Warm-up (5 minutes)

🧑‍🤝‍🧑 **Discuss** – Use a discussion strategy, like journaling, working at boards, selecting random students, or a form of think-pair-share.

- **Topic:** In Mission 5, students learned about analog and digital sounds.
- **Say:** In Mission 5 you learned about analog and digital sounds. What do you remember about analog and digital? Besides sounds, what else can be analog?
- **Say:** In today's mission, you will use analog light and convert it to digital information and then use it in a program.

Activity – Mission #12 (30 minutes)

💻 Randomly group students into pairs for pair programming.

Students log in to one computer. Two computers can be used if they want to see instructions on one computer and work on the other computer. However, the assignment document requires snippets, so it will need to be open on the same computer as CodeSpace.

💡 **Teaching tip – Before they start:**

Optional: Review the Mission Reminders slides.

Important! Remind students that they need to document their errors and how they fixed them. There is a table at the end of the assignment document for this.

Students go to sims.firialabs.com and should be at the beginning of Mission 12

💡 **Teaching tip – Objective 1:**

The objective introduces the light sensor. Students will locate the light sensor on the simulator.

💡 **Teaching tip – Objective 2:**

Students will use the light sensor in code. They will need to experiment a little and come up with their own value for darkness. The suggested value is 2000.

💡 **Teaching tip – Objective 3:**

Students will learn a new way to turn on all the pixels. They can compare to using a list.

💡 **Teaching tip – Objective 4:**

The code will require some math here. Students should use the hints and the CodeTrek to guide them. They will be adding the math inside the if statement. This is a logical place to create a function.

💡 **Teaching tip – Objective 5:**

Students will modify the math to include brightness. Once again, they should use CodeTrek to help with the code. If students created a function for Objective #4, they will modify the math in the function.

💻 **Teaching tip – Extension:**

Complete this mission if at all possible. It doesn't take very long. Students create a "kill switch" for the program. Also, encourage the students to turn off all pixels and include a message after the loop – not indented – that displays the program has ended.

💻 **Teaching tip – Challenge:**

This is completely optional. It is only for students who work very fast so they have something to work on throughout the class period. Students can add selection to their code by picking levels of brightness and showing an image on the LCD display as well as lighting the pixels.

✅ Assignment is complete and ready to turn in. Both students should include their names on the document.

✅ Determine how you want to check-off the student program (turn in text file, submit through LMS, observe on student computer, etc.)

✅ **IMPORTANT!!**

Students should clear their CodeX by running their ClearCodeX program.

Wrap-Up (5 minutes)

👩‍💻 **Vocabulary** – Review the vocabulary for today's lesson:

- **Analog:** Infinite variation in something, like hot to cold or light to dark; smooth and continuous signals that represent a quantity, like sound waves
- **Digital:** A numerical representation of an analog signal, represented in increments
- **ADC**: analog to digital conversion

👫 **Discuss** – Use a discussion strategy, like journaling, working at boards, selecting random students, or a form of think-pair-share.

👫 **REVIEW the TOPIC:** This project has introduced students to an area with lots of potential for improving the world! Light Sensors and LED 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 called Daylight Harvesting - it saves energy!
  - That's exactly what your last NightLight code was doing!

Formative Assessment:

- Daily reflection journal or form
- Completion of assignment and mission
- Exit ticket on vocabulary
- Group review on vocabulary
- Students create a vocabulary canvas with vocabulary words.

SUCCESS CRITERIA:

- ❏ The CodeX determines when it is dark and turns on the pixels.
- ❏ The brightness adjusts with the amount of darkness.
- ❏ Use at least one function in your code.