MISSION 12: Night Light	Time: 45-60 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.

Cross Curricular:

- **MATH:** Review the math for scaling the digital reading to a brightness, and the need to reverse the number.
- **SCIENCE:** Use the light sensor in an experiment, following the scientific method.
- Supports **language arts** through reflection writing.

Materials Included in the learning portal Teacher Resources:

Mission 12 Slidedeck

The slide deck is for teacher-led instructions that let you guide students through the material using the slides. It is an alternative to the students reading a lot of instructions in CodeSpace. The slides mirror the instructions, with simplified language that is chunked into smaller sections at a time. The information is shown on slides with “Objective”. The tasks to complete are on slides with “Mission Activity''.

Mission 12 Workbook

The workbook can be used instead of slides for student-led or independent work. It is an alternative to students reading a lot of instructions in CodeSpace. It mirrors the instructions (and the slide deck), with simplified language that is chunked into smaller sections at a time. Each objective is on its own page. The tasks to complete are labeled “DO THIS” and have a robot icon next to it.

Mission 12 Log

This mission log is the worksheet for students to complete as they work through the mission. It should be printed and given to each student before the mission starts. They write on the mission log during the assignment and turn it in at the completion of the mission (assignment).

Mission 12 Lesson Plan

The lesson plan comes from the original CodeX Teacher Manual and is included here for easy reference.

Mission 12 Remix Folder

Following Mission 12 students should complete a remix of their code.

Additional Resources:

- Mission 12 Solution (Spirit Level)
  - A code solution to Mission 12 in a text file
- Mission 12 Review Kahoot

Formative Assessment Ideas:

- Exit ticket
- Mission log completion
- Completed program
- Mission 12 Review Kahoot
- Student Reflection

Vocabulary: *No new vocabulary is required for this mission, but you can review these terms.*

- **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

Preparing for the lesson:

This mission will create a digital night light. As mission prep, you may want to discuss analog and digital. This is optional and not required for the mission. A slide deck from Mission 5 can be used.

Students will use the Codex throughout the lesson. Decide if they will work in pairs or individually.

- Look through the slide deck and workbook. Decide what materials you want to use for presenting the lesson. The slide deck can be projected on a large screen. The workbook (if used) can be printed or remain digital through your LMS.
- Be familiar with the Mission Log (assignment) and the questions they will answer.
- Print the Mission Log for each student or prepare it digitally.
- **Bring flashlights** for students to use for testing with a bright light.
- The mission program does not need to be portable. If you want students to use the CodeX without a cable, then have batteries available.

Lesson Tips and Tricks:

💡 **Teaching tip:**

You can use a variety of discussion strategies to get the most engagement from your students. For example, you can have students write their answers before asking anyone for an answer. You can use one of many think-pair-share methods. You can have students write their answer and share with someone, and then have other students share answers they heard from their peers. You can randomly select students to answer.

🧑‍🤝‍🧑 Pre-Mission Discussion (Slide 2, page 1):

Students can write in their log first and then share, or discuss first and then write in their log.

There is one question for the pre-mission. There isn't a "right" answer here. The purpose is to get them thinking about the need for selecting something random. Also, there are real-world applications to what they are learning.

- In this mission you will use CodeX's built-in light sensor. What real-world projects can it be used for?

💻 Mission Activities:

Most of this lesson is on the computer, writing code to make a night light.

- Each student will complete a Mission Log.
- Students could work in pairs through the lesson, or can work individually.
- Students will need the CodeX and USB cable.

💡 **Teaching tip: Objective #1** -- Slides 3-5, Pages 2-4

This objective gives a mild introduction to the light sensor. Students get information about the light sensor by clicking on the word and going to the toolbox.

Students will answer three questions in their mission log.

Students will need to identify the light sensor in the simulator. Then they will create their new file.

💡 **Teaching tip: Objective #2** -- Slides 6-7, Pages 5-6
Students learn about the values the light sensor will return, and then use the light sensor in the code.

Students will fill out a table in the mission log. They can get several different readings for room light, bright light and dark light. Students can pick any of the values, or even list a range.

🗝️ **NOTE:** The code example in the slide deck / student workbook is slightly different than the code in CodeTrek. It includes a sleep() command to slow down the scrolling of numbers on the screen. It won't affect the verifier and should make it easier for students to read the data.

💡 **Teaching tip: Objective #3** -- Slides 8-9, Pages 7-8
Students use the pixels.fill() to set all pixels one color. They add an if statement to turn on / off the pixels.

🗝️ **NOTE:** The value for the if statement is 2000 (if value < 2000). If this doesn't work well for the students, the number can be changed until it is working as desired. Darkness (like covering the light sensor with your hand) should turn on the pixels, and room light should turn them off.

💡 **Teaching tip: Objective #4** -- Slides 10-13, Pages 9-11
This objective discusses using brightness as an argument in the pixels.fill() command, so the pixel brightness can be adjusted (dimmable). Students will modify the if statement for dimming the pixels.

🗝️ **NOTE:** The key to this objective is picking a good value for ROOM. Students should refer to their table from Objective #2 and look at their reading for room light. The value for ROOM should be a little less. Students can try different values until they find one that works reasonably well.

🗝️ **NOTE:** The code will be glitchy. It will seem to work, but in darkness the pixels will not light, and in light they may light up. This glitchiness will be corrected in the next objective.

🗝️ **NOTE:** The math for scaling the digital reading to dim level is not explained in the workbook or slides. It is explained in CodeTrek if you want to go over it with your students. It involves percentages.

💡 **Teaching tip: Quiz** -- Slide 14, Page 11

Students take a ❓ short quiz. The 2 Quiz questions are below. One question is about reading the light sensor, and the other is a review of lists. You can decide if you need to go over the question with your students.

💡 **Teaching tip: Objective #5** -- Slides 15-16, Page 12
This objective corrects the glitchy night light. It involves reversing the math to get the correct dim target.

🗝️ **NOTE:** The math for reversing is not explained in the workbook or slides. It is explained in the online instructions if you want to go over it with your students.

💻 Mission Complete:

This mission ends with a completed, working program that will act as a night light. You need to decide how you will use the program for assessment. You could:

- Go to each student and check-off their code
- Have the students download their code to a text file and turn it in using your LMS
- Have students print their code (either download and then print the text file, or print a screenshot)
- Have students switch computers and run each other's code. Fill out a simple rubric and turn in to teacher
- Any other way that works for you

👫 Post-Mission Reflection:

The post-mission reflection asks students to think about real-world applications for light sensors, and also to reflect on their coding experience during the mission. You can change the questions if there is something else you want to emphasize with your students.

- What real-world applications use light sensors?
- You have now completed 10 coding missions and several remixes. Reflect on your experience learning to program:
    - What have been the challenges in learning to program?
    - What have been the rewards in learning to program?

End by collecting the Mission Log and any formative assessment you want to include.

💻 IMPORTANT Clearing the CodeX:

The students have already created a "Clear" program. Students should open and run "Clear" at the end of each class period.

SUCCESS CRITERIA:

- ❏ The CodeX determines when it is dark and turns on the pixels.
- ❏ The brightness adjusts with the amount of darkness.

❓ Quiz Questions