Before we start

Download the following files from here

- Download Smart Light Sketchbook

- Download worksheet (.docx file)

Objective

Create a system that **turns on an LED when it is dark and an object is detected.**

In this activity, you will...

1. Get introduced to **light sensor**

2. Learn basic **logic structures** (AND/OR operator)

3. **Combine two code snippets** and use **light + ultrasonic sensors** to achieve the desired behavior

What you will need in this activity

- TI MSP430 Board

- Grove Base BoosterPack

- 4-Pin Wire x 2

- Ultrasonic Sensor

- Light Sensor

- Micro B Cable

- Energia

- Smart Light Sketchbook
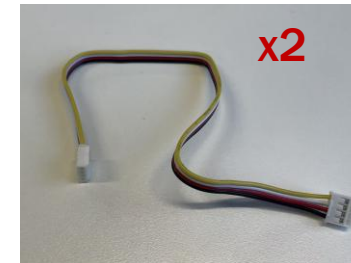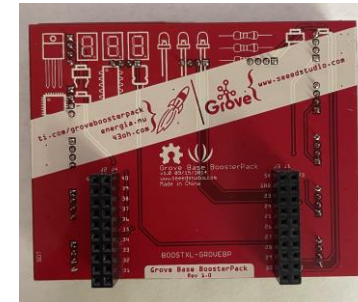
Introducing light sensor

- **Purpose:** Detects the brightness of the surrounding environment

- **Working principle:**

  - Uses a light-dependent resistor (LDR), also called a photoresistor (made from a semiconducting material, i.e. cadmium sulfide)

  - Its electrical resistance decreases when light shines on it

    - In darkness, few charge carrier are available

    - In light, photons excite electrons, thus more carrier and lower resistance.

- **Output:** Returns a value between 0-1023 where lower values means darker environment, vice versa.

Logic Operators & Gates

In programming and electronics, **logic operators** let us **combine multiple conditions** to control what happens.

AND Operator &&

Both conditions must be TRUE to activate

A	B	A AND B
False	False	False
False	True	False
True	False	False
True	True	True

OR Operator ||

At least one condition must be TRUE to activate

A	B	A OR B
False	False	True
False	True	True
True	False	True
True	True	True

Smart Light: *Sanity Check*

- **Step 1:** Connect the everything as shown on the right.

- **Step 2:** In Energia,

  - Navigate to sketchbook → smart_light→ `light`, and run the code to see if the red LED lights up when you cover the light sensor with your hand.

  - Navigate to sketchbook → smart_light→ `ultrasonic`, and run the code to see if the red LED lights up when you move your hand close to the ultrasonic sensor.
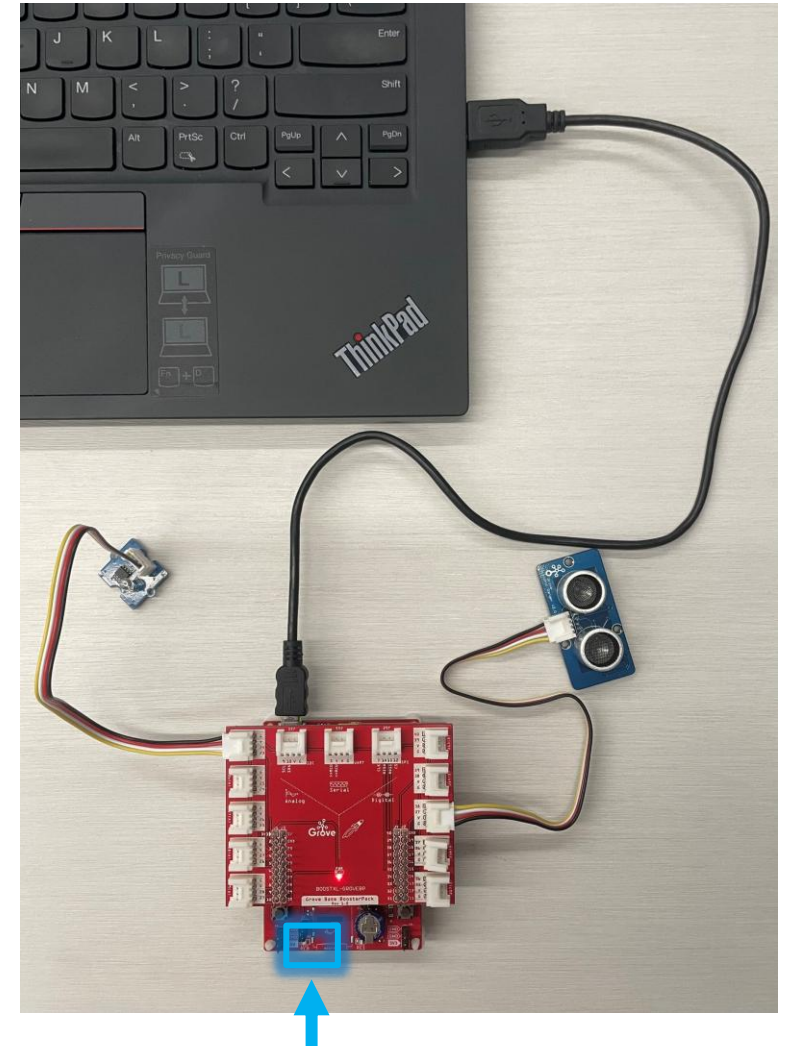
Chek if the red LED HERE lights up

Smart Light: *Logic Development*

- **Step 3:** (Task 1) With the knowledge of the two pieces of code, write a pseudocode or draw a flowchart to show how to turn on the LED when BOTH of the following conditions are met:

    1. When the environment gets dark

    2. When an object is within a certain distance of the ultrasonic sensor

Hint:

- Recall the selection structure from the previous activity

- Use an appropriate logic structure

Smart Light: *Code Synthesis*

▪ **Step 4**: (Task 2)

Navigate to sketchbook → smart_light→ `smart_light`(which is now identical to `ultrasonic`), you need to

1. Copy the relevant code from `light` example file and paste it to `smart_light`

2. Modify the selection structure(i.e. the `if` condition) by using the appropriate logic operator(e.g., `&&`) to combine both sensor conditions and achieve the desired behavior.

Goal: LED should turn on only when both conditions are met.

Smart Light: *Logic Gates Experiment*

- **Step 5**: (Task 3) Change the if conditions to the following and record your result in the answersheet.

    1. ((brightness < darkThreshold) && (distance < distThreshold))

    2. ((brightness < darkThreshold) || (distance < distThreshold))

    3. !(distance < distThreshold)

    4. ((brightness < darkThreshold) && !(distance < distThreshold))

Note: the conditions here are just for demonstration purpose, you need to use your own parameters.

Submission Instructions

- Download the following files from here
  - Instruction
  - Worksheet
  - Others if needed
- Complete the **.docx** file with your answers, and rename it to **ENGR131_ICA_YourName.docx**
- Submit **only the .docx file** on **Brightspace > Content > In-Class Activity Drop Box.**