# **Planning**

**Improving environmental conditions in the lab**

**Defining the problem**

Client: Mr. Jaime, a high school chemistry teacher at Gimnasio de los Cerros, seeks to enhance the environmental conditions in the lab to ensure a safe space and prevent the spread of COVID-19. He requires a device that can determine the concentrations of carbon monoxide and carbon dioxide in the chemistry lab. When either or both concentrations exceed the environmental limits, the device should alert him so that appropriate measures can be taken.

In September 2021, Mr. Jaime shared his concern with me during a chemistry class. He expressed his desire for a device featuring two gas sensors: one for carbon dioxide and another for carbon monoxide. The device should notify him when either or both concentrations exceed a predefined limit, allowing him to take necessary precautions.

Recognizing the potential for this problem to serve as the subject for my internal assessment and my interest in electronics experimentation, I consulted with my computer science teacher (advisor), who approved the idea.

To analyze the issue further, I arranged a meeting with Mr. Jaime to conduct an interview and discuss the details of my future device.

During my consultation with Mr. Jaime and my advisor, I proposed the development of a sensor box. This box would house both gas sensors, a buzzer, two differently colored light bulbs (one for carbon dioxide and the other for carbon monoxide), and an LED screen. The objective of this setup is to visually alert Jaime whenever a concentration exceeds a limit.

Rationale:

To address Jaime's problem, my device will utilize light bulbs, a green one for carbon dioxide and a red one for carbon monoxide, to indicate when a gas concentration surpasses the limit. Additionally, when either or both light bulbs are on, the device will emit a noisy sound. The device will incorporate a display to provide Jaime with real-time information about the concentration levels.

I believe that using Arduino software and hardware will be instrumental in solving Jaime's problem. Arduino is user-friendly, microcontrollers are cost-effective and readily available, and I am already familiar with the C++ programming language used in Arduino.

The primary advantage of developing this device for Jaime is that he will no longer have to worry about monitoring the environmental conditions in the chemistry lab. He will be promptly alerted if the gas concentrations pose a risk to individuals in the lab.

I have chosen to employ Arduino for the device's development for the following reasons:

- It is part of my curriculum at school.

- The Arduino Integrated Development Environment (IDE) is freely available.

- Arduino boards are affordable.

- Arduino offers great flexibility, enabling the implementation of various functionalities.

- The Arduino community provides extensive support and resources.

- The Arduino IDE is compatible with multiple operating systems.

Success criteria:

1. Display accurate data gathered from the modules on the screen.

2. Display the predetermined thresholds for each concentration.

3. Continuously collect data for both carbon monoxide and carbon dioxide concentrations.

4. Activate the buzzer and illuminate the appropriate light bulb(s) when a concentration surpasses the established limit(s).