Hazardous Gas Detector

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ABSTRACT

The monitoring of hazardous gases, such as carbon dioxide (CO2), is critical for ensuring the safety of workers in enclosed environments such as spacecraft. This research project focuses on the design, development, and coding of a compact CO2 detector.

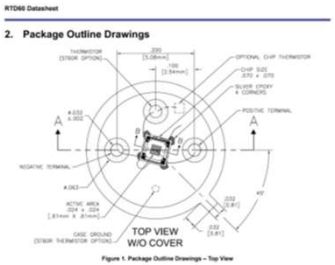
My design utilizes a Raspberry Pi Pico microcontroller connected to an RTD60 thermopile gas detector. The microcontroller was then programmed to analyze the input from the sensor and determine the CO2 levels in its environment.

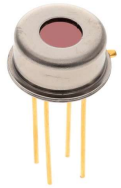
The RTD60 gas detector was soldered to four wire leads and connected to the microcontroller. Three LED lights are incorporated into the design to provide visual alerts based on the CO2 levels: green for safe, yellow for caution, and red for danger.

MicroPython, a high-level programming language, was used to code the microcontroller. The code is written to continuously read the input from the sensor and to calculate the results. Based on those results the controller would then activate the appropriate LED indicator. The code also includes an output to the user, giving them live readings from the detector.

An enclosed area was constructed for testing. A valve and CO2 cartridges were used to administer the gas. The detector proved to be accurate and reliable. The compact size, low power consumption, real-time readings, and alerts make this CO2 detector a valuable tool to ensure the safety of workers in any enclosed environment. My insights gained from this project have given me valuable experience in the design, construction, and coding of instruments and detectors such as my hazardous gas detector.

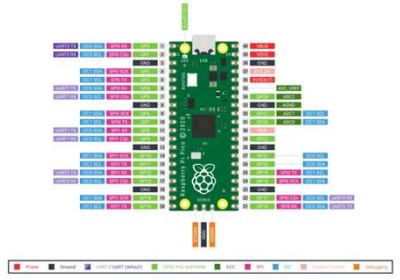
RTD60 THERMOPILE GAS DETECTOR





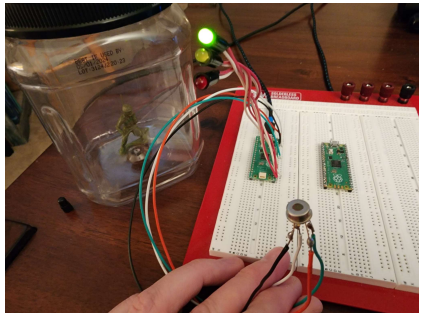
The RTD60 thermopile gas detector is the key component in this project. It uses the non-dispersive infrared absorption method to detect the presence of gas, in this case carbon dioxide. The sensor contains an infrared light source. This infrared light is then passed through a filter that only allows the wavelengths of light that is absorbed by CO2. If CO2 is present, it will absorb this light, therefore decreasing the amount of light received by the thermopile detector. This drop in light causes a temperature difference which generated an electrical current. This current can be read by the microcontroller and can determine the amount of CO2 present. This system allows for continuous live reading and consumes very little power which makes it perfect for use with the Raspberry Pi Pico microcontroller used in this project.

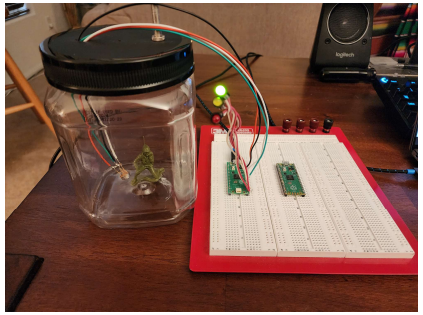
RASPBERRY PI PICO MICROCONTROLLER

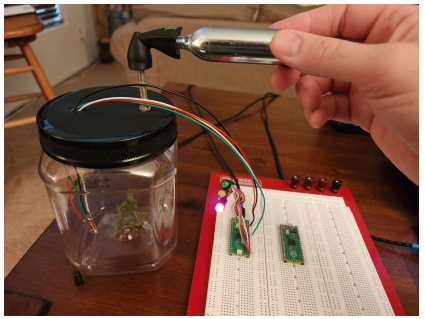


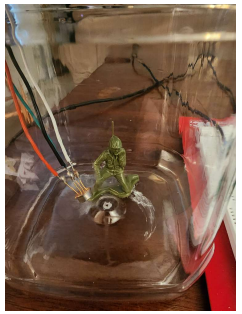
MICROPYTHON CODE

```
while True:
    # Read the thermistor and gas sensor values
    thermistor_value = thermistor.read_u16()
    gas_sensor_value = gas_sensor.read_u16()

    # Print the values
    print("Thermistor Value:", thermistor_value)
    print("Gas Sensor Value:", gas_sensor_value)

    # LEDs based on sensor values
    if gas_sensor_value <= 12000:
        led_G.value(1)
        led_Y.value(0)
        led_R.value(0)
    elif gas_sensor_value > 12000 and gas_sensor_value < 13000:
        led_G.value(0)
        led_Y.value(1)
        led_R.value(0)
    else:
        led_G.value(0)
        led_Y.value(0)
        led_R.value(1)

    time.sleep(1)  # Wait for 1 second before the next reading
```









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