Lab 1 Report: Sensors and math

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1 Preparation

1.1 Q1: Find the mathematical relationship that relates our input sensor (i.e., rotary dial) to the desired output (i.e., buzzer frequency). The aim is to scale the rotary output range to be between 300 and 2000.

I can use the general form of an equation of a line:

$$y = m(x - x_1) + y_1 \tag{1}$$

Since the range of our input (i.e., the rotary dial) is between 0 and 1023, the slope can be calculated as

$$m = \frac{2000 - 300}{1023 - 0} \tag{2}$$

Following this, the final equation can be expressed as

$$y = m(x - 0) + 300 \tag{3}$$

where x here is the dependant variable, which denotes the rotary dial input.

1.2 Q2: List three different ways you can manipulate the sensor and record the output or change in the output you should observe because of this. For example, if your rotary dial is turned completely to the left, what will be the observed output? This is one test case.

Since the relationship is linear between the input and output sensors, I expect the following:

1. When the dial is turned completely to the left, considering that it is at the minimum value, 0, I expect the dial tone to be at the minimum too, operating at 300Hz.
2. When the dial is turned completely to the right, considering that it is at the maximum value, 1023, I expect the dial tone to be at the maximum too, operating at 2000Hz. In this case, I expect to hear a much higher tone than the previous test.
3. when the dial is positioned in the middle, near 500, I expect to hear a pitch that is higher than test 1, but lower than test 2. The frequency should be near 1131.

2 Procedure

2.1 Q1: In your logbook, record the coding part related to the temperature (i.e., steps 3.2.1, 3.2.2, 3.2.3).

The coding part is submitted in a separate .py file, and the coding part is labeled (using comments) according to the question number.

2.2 Q2: Did you encounter any errors? What are they? How did you solve them?

- I tried to get the readings of the rotary dial using analog_read(A0). However, I got an error saying that the function input is invalid.
  - I revised the lab procedure guidelines and realized that the input should only be the port number, which is 0.
- I called the buzzer frequency function as buzzer_frequency(5,y), but y here was a float, so I got an error that the function does not accept this input.
  - I asked for help and learned that the function only takes integer numbers, so I modified the function call to buzzer_frequency(5, int(y))

3 Testing

Test	Frequency (Hz)	Observations	Comments and Investigations
Rotary dial at the min. position 0	2006 out of range	After modifying the code, $y = 300$	The design equation was wrong, I forgot to add 300, modified it and it worked.
Rotary dial at middle position 500	528 Doesn't make sense	$y = 1130.5$. I hear a mid-pitch sound	The variable t wasn't updated to 500, it was evaluating to 137, I updated it and it worked.
Rotary dial at max. position 1023	2000	Very high tone	Matches the expectations!

Table 1: An example table - include more details as required.