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ECE 140a Lab 2 Writeup

Part 1 - MCP3008/Photoresistor:

1) Is the datasheet correct for your current environment? Measure the actual resistance using an ohmmeter. Find the range of values in your readings.

Dark resistance in the datasheet says 1 Mohm (min). Our calculated resistance was 10M ohm.

Regular ambient light -> 20K

No light -> 10M

Full light -> 0.042k

2) Given our input voltage and our resistor values, what is the voltage range for the output of the voltage divider circuit?

The known output values for the voltage divider will be ranging from 0 to $2^{10} - 1$ (1023).

V_{in}	R1 (photodiode)	R2	Vout (Calculated)	MCP
5V	10M ohm	9.84K ohm	0.04452 V	243
	0.042k ohm	9.84K ohm	4.97 V	1023
3.3 V	10M ohm	9.84K ohm	0.0032472 V	139
	0.042k ohm	9.84K ohm	3.3 V	1020

Table 1

3) Given the voltage range of our photocell circuit, and the range of our ADC, what are the possible values that the MCP might output from channel 2's input?

$$1023/5 = V_{out}(\text{chip}) / V_{in}(\text{Voltage divider})$$

$$204.6 * V_{in}(\text{min}) = 204.6 * 0.04452 = V_{out}(\text{min, MCP}) = 10$$

$$204.6 * V_{in}(\text{max}) = 204.6 * 4.97 = V_{out}(\text{min, MCP}) = 1017$$

$$V_{out, \text{mcp}} = 0 \sim 1023$$

4) Were they within your calculations? Why or why not?

They were not in our calculations as the provided photocell circuit was wrong. The provided photocell circuit prompted us to use the 5V rail coming out of the Raspberry Pi. This is incorrect as we should be using the 3.3V rail. The 3.3V rail should be used because the 3.3V rail is powering the analog to digital converter being used in the circuit. Due to this the voltages were not within our calculation and we observed that sensor would cap out at (1023)(double check) at about 3.3V and additional values that were not accounted for by the circuit.

5) What is the problem? Find the problem with the circuit, fix it, calculate the voltage ranges again, and check them against the MCP output.

The problem is that the voltage input range of the MCP3008 is $0 \sim 3.3$. When we fed V_s of 5.0 V, any input value of 3.3 were interpreted as 1023, resulting in inaccurate reading of the chip. After identifying the problem, we supplied 3.3 V into the voltage divider circuit using the '3.3V' pin of the Raspberry Pi. Calculated / measured voltage against MCP readings are noted in table 1.

Data Readings

MCP Readings

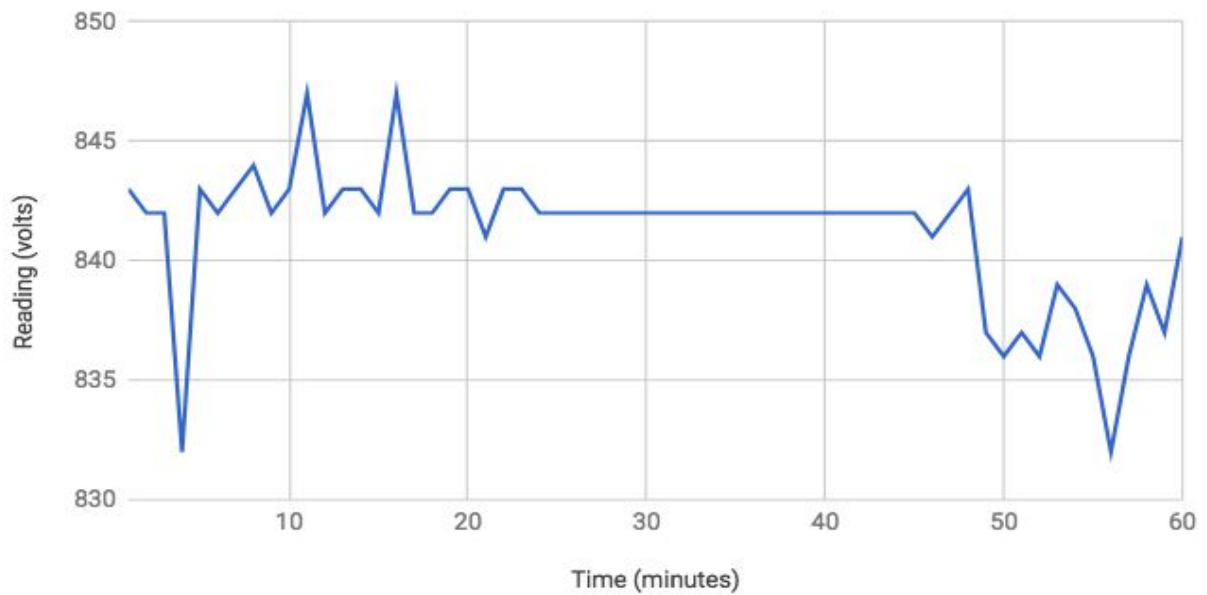


Figure 1

These are the readings for the photoresistor

DHT Temperature readings (C)

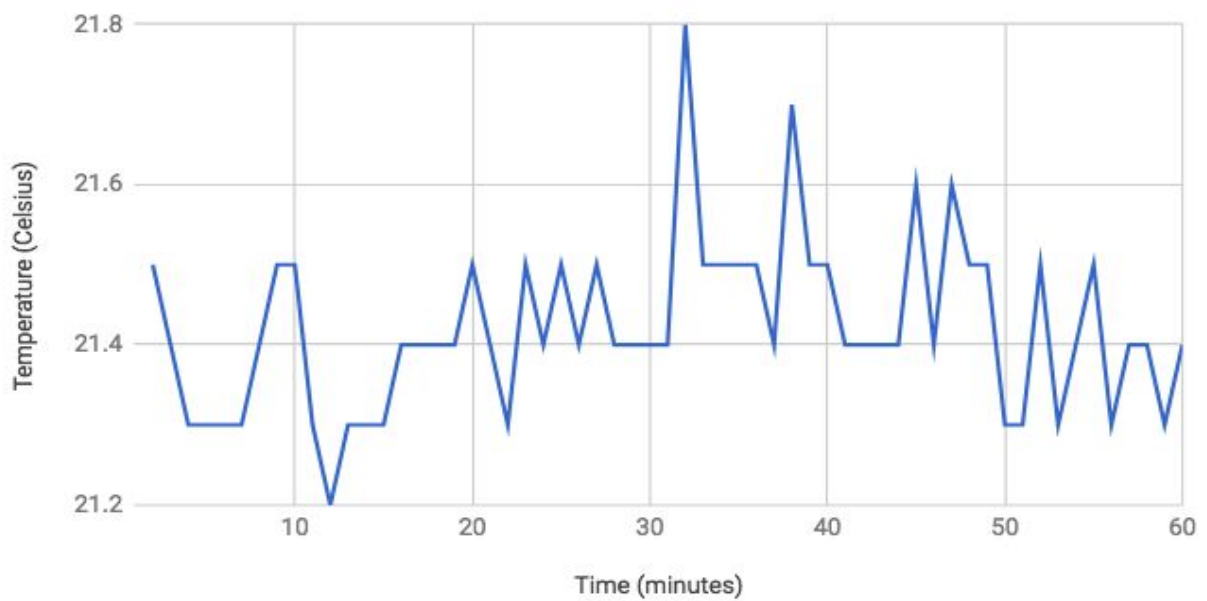


Figure 2

These are readings for the DHT temperature in Celsius

DHT Temperature Readings (F)

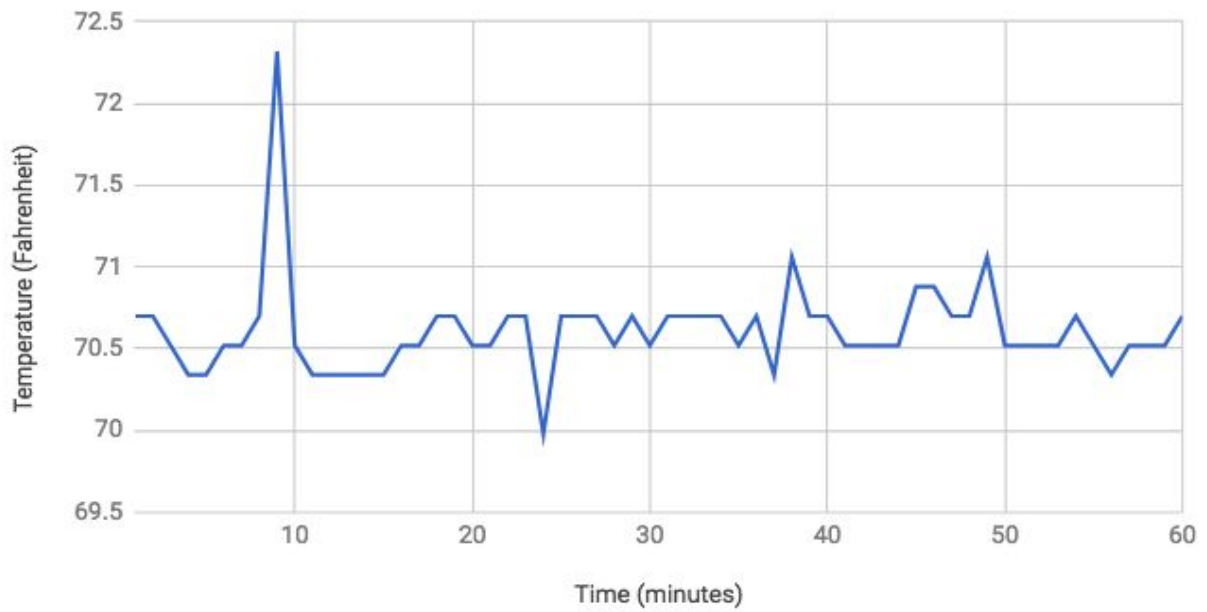


Figure 3

These are the temperature readings in Fahrenheit

DHT Humidity

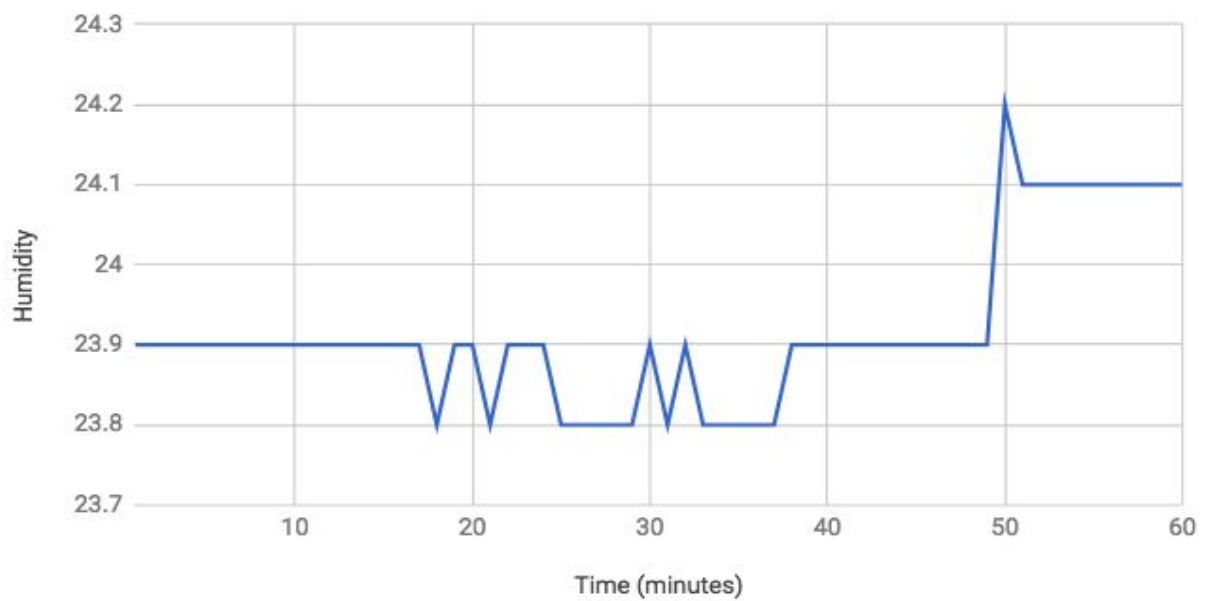


Figure 4

Readings of humidity

Link to excel sheet with all lab data:

<https://docs.google.com/spreadsheets/d/1GN78JiP-1iDj99WB1eK98rxj7ZTg5VNJt91e29Snbl4/edit?usp=sharing>