

ECE 476/676 - Homework #8

*Text Files, Temperature Sensors - Due Monday, October 27th
revised - set the sampling rate to 1 second*

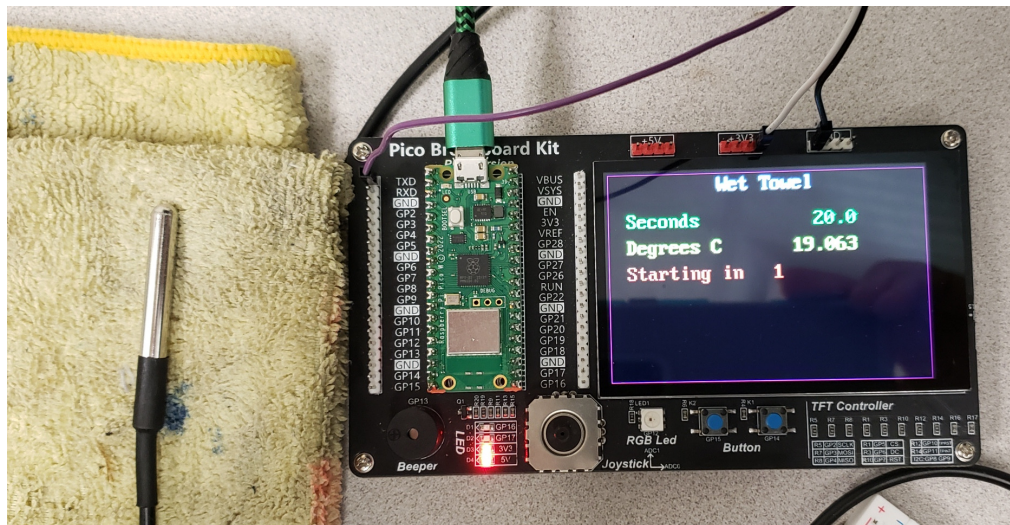
How Much Cooler is a Wet Towel?

Determine how much cooling you get by blowing air over a wet towel.

Software

1) Write a Python program which

- Waits until you press GP15 (start of data collection)
- Once pressed, it waits 5 seconds then beeps and starts collecting data
 - Data consists of temperature readings from a DS18B20 sensor
 - One data point every 1000ms
 - For 20 seconds (20 data points)
 - Data is saved as a text file on your Pico board
 - Different names for each data run
- After 10 seconds (10 data points), it beeps again
- After 20 seconds (20 data points), it stops collecting data



Python Code

```
import onewire, ds18x20
from machine import Pin, ADC, Timer
from time import sleep, sleep_ms
import LCD
import matrix
from math import log, exp

B0 = Pin(15, Pin.IN, Pin.PULL_UP)
B1 = Pin(14, Pin.IN, Pin.PULL_UP)
Beeper = Pin(13, Pin.OUT)

ds_pin = Pin(0)
ds_sensor = ds18x20.DS18X20(onewire.OneWire(ds_pin))

roms = ds_sensor.scan()
print('Found DS devices: ', roms)

flag = 1
T = 1

def tick(timer):
    global flag
    flag = 1

def Beep():
    Beeper.value(1)
    sleep_ms(10)
    Beeper.value(0)

Time = Timer()
Time.init(period=1000, mode=Timer.PERIODIC, callback=tick)

file1 = open("HW8_Wet_Towel.txt", "a")
file1.write('-----\n')
file1.write('-Trial #3 part b -\n')
file1.write('Seconds  Degrees C\n')

Navy = LCD.RGB(0,0,5)
LtGreen = LCD.RGB(100,250,50)
Yellow = LCD.RGB(250,250,0)
Orange = LCD.RGB(250,150,50)
Red = LCD.RGB(250,50,50)
Plum = LCD.RGB(200,50,150)
White = LCD.RGB(250,250,250)
Grey = LCD.RGB(100,100,100)

LCD.Init()
LCD.Clear(Navy)
LCD.Box(2,2,478,318,Plum)
LCD.Title('Wet Towel', White, Navy)
LCD.Text2('Seconds',30,60, LtGreen, Navy)
LCD.Text2('Degrees C',30,100, Yellow, Navy)
time=a=b=n=0

while(B0.value() == 1):
    pass
LCD.Text2('Starting in ', 30, 140, Orange, Navy)
time = 5
flag = 0
while(time > 0):
    LCD.Text2(str(time), 250, 140, Orange, Navy)
    while(flag==0):
        pass
```

```

    time -= 1
    flag = 0

time = flag = 0
Beep()

while(time < 20):
    while(flag == 0):
        pass
    flag = 0
    ds_sensor.convert_temp()
    sleep_ms(750)
    T = ds_sensor.read_temp(roms[0])
    time += 1
    print(time, T)

    file1.write(str('{: 4.0f}'.format(time)) + " ")
    file1.write(str('{: 7.4f}'.format(T)) + " ")
    file1.write("\n")

    LCD.Number2(time, 9, 1, 200, 60, LtGreen, Navy)
    LCD.Number2(T, 9, 3, 200, 100, Yellow, Navy)

    if(time == 10):
        Beep()

file1.close()
Beep()
sleep_ms(100)
Beep()

```

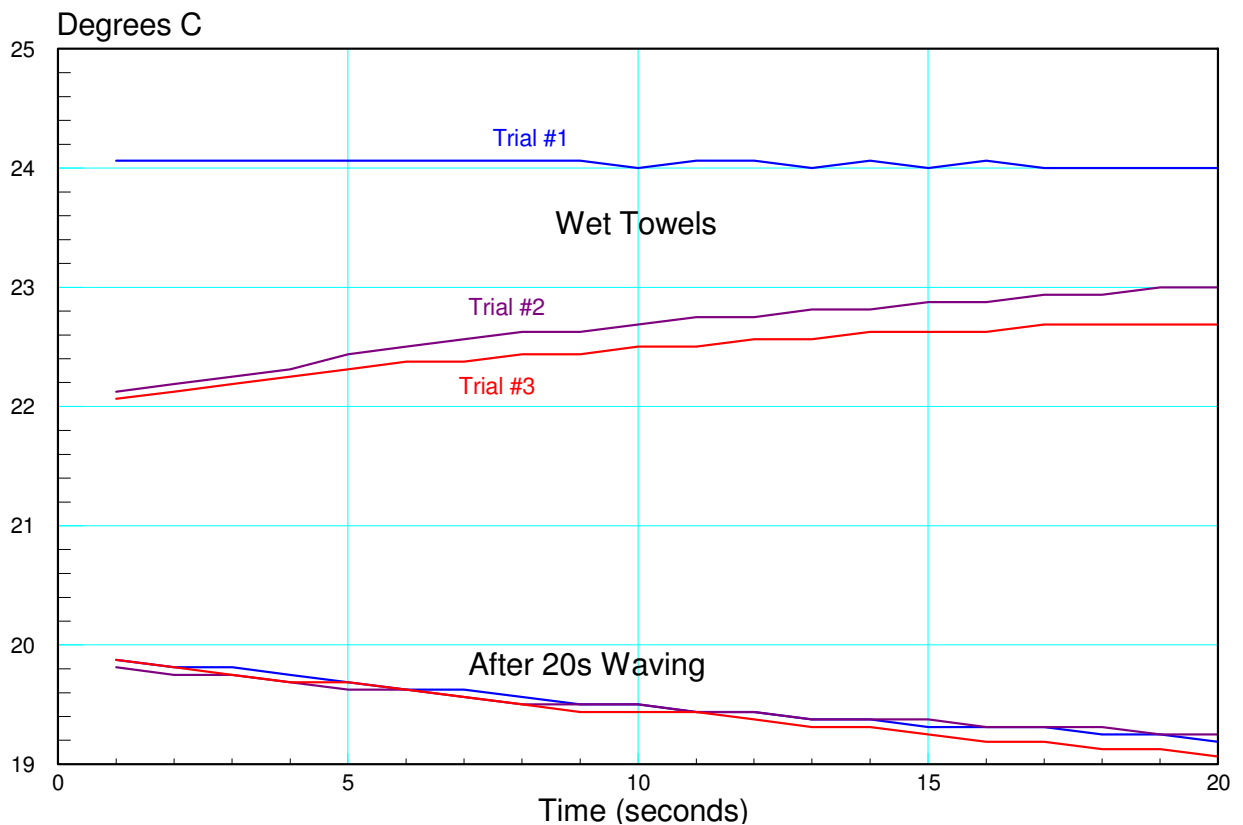
Data Collection

2) Measure the temperature of a wet towel

- Soak a towel in cold water then squeeze it to dry
- Place the a DS18B20 sensor on/in the towel
- Start data collection (press GP15)
- Wait for the first beep (at 5 seconds: data collection starts)
- At second beep, start blowing air over the towel and sensor
 - Turn on a fan
 - Wave a fan over the towel
- Wait for the third beep (data collection is done)

Plot the raw data

- Display as a graph rather than 20 numbers



3) Repeat three times noting

- The temperature at 10 seconds for each run
- The temperature at 20 seconds for each run
- The temperature drop due to cooling

	Run #1		Run #2		Run #3	
	Start	Cooling	Start	Cooling	Start	Cooling
T(10s)	24.000	19.500	22.6875	19.5000	22.5000	19.4375
T(20s)	24.000	19.250	23.0000	19.2500	22.6875	19.06
dT @ 20s	-4.7500		-3.7500		-3.6275	

Data Analysis

4) Use a student t-test to determine the 90% confidence interval for how much cooling you get from blowing air over a wet towel.

The t-score for 5% tails and 2 degrees of freedom (sample size = 3) is 2.91999

In Matlab

```
>> dT = [-4.7500, -3.7500, -3.6275]
dT =    -4.7500    -3.7500    -3.6275
>> x = mean(dT)
x =    -4.0425
>> s = std(dT)
s =     0.6158
>> x + 2.91999*s
ans =    -2.2445
>> x - 2.91999*s
ans =    -5.8405
>>
```

Waving a wet towel for 20 seconds will result in the towel cooling down by (2.24C to 5.84C) with a probability of 0.9