Group Tech Lab Exercise #1

Required Materials:

- RPi3 preloaded with Raspbian Stretch
    - Password = abe201 (please do not change!)
    - Change hostname to your group number, ie abe201-group03
- Breadboard x2 (1 board is possible, but it will be cramped!)
- ADC Analog to Digital Converter
- TGS2600 Air Quality Sensor
- DHT11 Digital Humidity/Temperature Sensor
- LDR Light Detecting Resistor
- Pi Cobbler, breadboard interface with ribbon
- 1uf (uf = micro farad) >=5V capacitor
- 10k Resistor
- 12+ jumper cables
    - Be consistent with colors! 1 color each for power +/-, data, etc.

Wiring: ADC --> Cobbler
Datasheet: https://cdn-shop.adafruit.com/datasheets/ads1115.pdf
The RPi is not capable of reading analog values. The ADC module reads the analog signal and converts into a digital value the RPi can read.

- VDD - 3.3v pin 1
- GND - GND (any)
- SCL - SCL pin 5
- SDA - SDA pin 3
- A0 -
- A1-
- A2 -
- A3 - TGS2600 A0

WIRING: DHT11
Datasheet: http://www.micropik.com/PDF/dht11.pdf
Measures temperature and humidity with a fair amount of accuracy (the DHT22 is more accurate, and other models include additional environmental sensors, such as barometric pressure).

- VCC - 3v3 (either pin 1 of cobbler or VCC of ADC), bridge to DATA w/ 10k resistor
- DATA - pin 4 cobbler, bridge to VCC w/ 10k resistor
- GND - GND (any)

WIRING: TGS2600
Datasheet: http://www.figarosensor.com/products/2600pdf.pdf
Detects Carbon Monoxide, Hydrogen, Methane (CH4), Ethanol, and Iso-butane by measuring electrical conductivity across a built-in heating element. It only spits out one number, which can be interpreted as parts per million. Review datasheet for more details.

- G - GND (any)
- AO - a3 of ADC
- DO - not used
- V - 5v, pin 2 or 4 of cobbler

WIRING: LDR (bipolar, pick a leg)
Datasheet: http://kennarar.vma.is/thor/v2011/vgr402/ldr.pdf
This sensor works by reading the voltage built up in the capacitor rather than by measuring resistance directly.

- pin 1 - 3.3v

- pin 2 – pin 12(18) of cobbler w/ a 1uf >=5v capacitor tied to GND (capacitor is NOT bipolar, + to pin12(18) and - to GND)

```
#ABE201 Environmental Sensor Suite v1.1
#bclittle@email.arizona.edu
#this code requires several dependencies
#pre-imaged card or internet connection needed


import datetime
import time
import RPi.GPIO as GPIO, time, os
import Adafruit_DHT
import Adafruit_ADS1x15


DEBUG = 1
GPIO.setmode(GPIO.BCM)


def RCtime (RCpin):
        reading = 0
        GPIO.setup(RCpin, GPIO.OUT)
        GPIO.output(RCpin, GPIO.LOW)
        time.sleep(0.1)

        GPIO.setup(RCpin, GPIO.IN)
        # This takes about 1 millisecond per loop cycle
        while (GPIO.input(RCpin) == GPIO.LOW):
                reading += 1
        return reading

now = datetime.datetime.now()


adc = Adafruit_ADS1x15.ADS1115()
GAIN = 1


# set delay in seconds, 900 = 15 minutes
#delay = 900


#setup for humidity sensor
sensor = Adafruit_DHT.DHT11
pin = 4
humidity, temperature = Adafruit_DHT.read_retry(sensor, pin)
```

```python
temperatureF = temperature * 1.8 + 32


while True:

        print "_____"
        print str(now)
        tgs = [0]*4
        for i in range(4):
                tgs[i] = round((adc.read_adc(i, gain=GAIN) / 3.3 * .100), 2)
        print("Air Contaminants : {3} ppm". format(*tgs))
        ldr = round((RCtime(18)), 2)
        print("Light Intensity :{} (less is more!)". format(ldr))


        if temperature is not None:

                print('Temperature : {0:0.1f} *C'.format(temperature))

                print('Temperature : {0:0.1f} *F'.format(temperatureF))

        else:

                print('Temperature read failed.')


        if humidity is not None:

                print('Humidity : {0:0.1f} %'.format(humidity))

        else:

                print('Humidity read failed.')


#trying to append all that to a log

        slog = open('sensorlog', 'a+')

        slog.write('{},'.format(now))

        slog.write('{3},'.format(*tgs))

        slog.write('{},'.format(ldr))

        slog.write('{0:0.1f},'.format(temperature))

        slog.write('{0:0.1f},'.format(temperatureF))

        slog.write('{0:0.1f}\n'.format(humidity))

        slog.close()


#       time.sleep(delay)

        break
```

When finished you should have an entry for temp.sh, cputemp.py, and sensors.py in crontab:

sudo crontab -e

- */15 * * * * /home/pi/./temp.sh
- */15 * * * * python /home/pi/sensors.py
- */15 * * * * python /home/pi/cputemp.py