Intro

Welcome to Lab 3!

In this lab you will add the final (provided) sensor to your SmatPlug platform. Similar to the last lab, we will learn about common obstacles in electronics prototyping. Additionally, we will be building a custom PCB for the SmartPlug, which will drive you one step closer to an actual product.

Your lab objectives for this session are:

- Adding a Sound Sensor to your SmartPlug
- Soldering
- Create a library for the Sound Sensor
- Design and (optionally) fabricate your PCB

Sound Detector

In order to set up the sound detector, Sparkfun has provided us with a “hookup guide”:

https://learn.sparkfun.com/tutorials/sound-detector-hookup-guide

Note that this is meant to work for their Arduino-compatible board, the RedBoard. You can use the MCP3008 as a substitute for the analog inputs (envelope, audio) to the board.

Once you connect the sensor, read the different values: Gate, Envelope, and Audio. Use the Oscilloscope and **include a picture in your lab report.**

- **What is the range of these values?**
- **Are they what you expect?**
- **Are they correct?**

Spoiler alert: You cannot connect the Sound Detector to the Raspberry Pi in the same way as an Arduino. Similar to the previous lab, logic levels are at fault.

The logic level of the sound detector output is 5V. The MCP is operating at 3.3V, so you must step down the sound detector output.

Fix the output of the sound detector. Submit a circuit diagram with your solved circuit.

Redo the measurements with your modified circuit. Include a picture in your lab report that contains:

- **The output of the Audio pin of the Sound Detector on CH1 of the Oscilloscope.**
- **The input of the Audio signal into your MCP3008 on CH2 of the Oscilloscope.**

Those two readings should show the same signal on two different logic levels (5V and 3.3V)

SmartSound Library

Similar to last week's lab, you will be writing an interface to the Sound Sensor.

These are the specifications for the Library:

SmartSound

Filename: SmartSound.py
Functions:

- get_gate()
    - Gets the gate value. Returns a boolean.
- get_envelope()
    - Gets the envelope value.
- get_audio()
    - Gets the audio value.

Additionally, the constructor must accept the GPIO and MCP3008 channel pin numbers for the gate, envelope, and audio.

Any additional functions are allowed, though they will not be tested or corrected. Creating something more sophisticated than getting those three values might help with the next part of the lab.

Append the three sound sensor values to your 'main.py' file from the previous lab assignment. That is, every minute for an hour, read the three readings. Graph the resulting data, and describe the environment it gathered data from.

Clapper Circuit

Design a simple circuit that toggles an LED on and off when you clap. Name it clapper.py.
(It is recommended to develop this in a quieter environment than the lab)

That’s it.

Milestone 4: EAGLE CAD

Follow these Sparkfun tutorials to learn everything you need about EAGLE:

https://learn.sparkfun.com/tutorials/how-to-install-and-setup-eagle
https://learn.sparkfun.com/tutorials/using-eagle-schematic
https://learn.sparkfun.com/tutorials/using-eagle-board-layout

You must design a PCB that has (at least) the following characteristics:

- Ability to connect to the Pi
    - Via a Ribbon cable, or in the cape/hat/shield form factor.
- Sound sensor
- DHT22
- MCP3008
- Photocell
- Power LED
    - On when the Pi is on, off otherwise.
- General Purpose LED
    - Controlled via GPIO
- Serial Communication Jumpers (RX, TX, GND, V)

If you have improved your design with more than those sensors, then you are free to add them to your design. There are no other constraints to the PCB, you can choose the shape you want, the size you want, and anything else; as long as it works. You have complete creative freedom.

If you wish to have your Printed Circuit Board fabricated, please finish your design as soon as possible. This step is optional, but highly encouraged. It will simplify carrying your project around, and provides a very valuable experience. It will also strongly support your final project.