Electronics Project (Engn 208, winter 2019): Detailed Project Proposal

Due: Wed, 30 Jan 2019, noon.

System Overview: Aims, Objectives, Constraints

1. Describe the **aim** of your project. What are you building and what real world problem does it attempt to solve?

2. What are **constraints** of your system? For instance, you might have a size constraint design might need to small and fit inside a small diameter cylinder bored out of a rock; or fit snugly inside a camelback.

3. What are **objectives** of your system design? These are attributes you want to maximize or minimize. These could be cost, power consumption, etc.

Electronics System Design

1. **Sensors**: What physical quantities or attributes must your system sense? What sensors/instruments will you integrate into your design (e.g., pressure, temperature, resisitivity, infrared radiation, acceleration, etc.)? How many of each sensor will you need? Identify potential parts/devices you can incorporate (recommend to go digging through the wonderful treasure trove of parts on Sparkfun and Adafruit)

2. **Actuators**: What actuators do you need? These could be speakers, motors, warning lights, etc.

3. **Data storage requirements**: Do you need to log data for off-line analysis? If so, how much data do you have to store in units of bytes? Choose an appropriate microSD card for data storage.

4. **Communication Protocols**: How will the user interact with the system? Does the user need to see data in real-time? What are your data bandwidth requirements and what communication protocols will be required (e.g. USB wired connection; Wireless option such as Bluetooth, BLE, XBee, Wifi)? For instance, you may need to sample the pressure 1 once every 10 seconds, and each sample is 16 bits = 2 bytes (2 bytes/10 seconds is very low bandwidth). Or you might be sampling thermal images once every second (100 x 100 pixels/frame x 2 bytes/pixel x 1 frame/s = 20kB/s = medium bandwidth). Do you need more than one unit in communication? For

instance, if you have a drawbridge sensor installed on 5 bridges, they all need to communicate, so you might need to think about mesh networking protocols.

6. **Computational Demands**: Do you need to take running averages (relatively low computational overhead)? Compute math models or run Fourier Transforms for sound production or analysis (relatively high computation overhead)?

7. **Microcontroller Unit (MCU)/DevBoard**: Identify a microcontroller that has sufficient computation speed, communication protocols, and I/O ports to connect to your sensors and actuators. Strongly suggest Teensy (over Arduino); Adafruit Feather boards (integrates MCU + wireless communication all in one); ESP8266 thing (if you need wifi); Particle Photon (mesh networking); RasPi (if you need heavy duty computational power).

8. **Power Requirements/Source**: What are power requirements of your system, and how will the system be powered? Perhaps you have a microwave where you simply plug your system into a wall jack. Or perhaps your design must be portable and therefore must be battery powered. How long must your system stay powered at bare minimum? What is the current draw (units of mA)? Suggest looking at Lithium Ion and/or Lithium Polyion (LiPo) batteries. If potential contact with water is a concern, you should think about a coin cell battery instead.