ECE/CS 6780 Mini Project

Water Leak Detection

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Project Overview

Goal: A water leak detection system that does not require a plumber to install

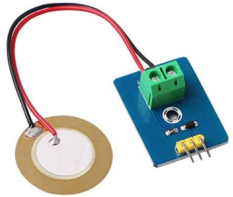
- Easy for homeowners to set up
- Works on wide variety of pipes
- Understands common home water use-cases (sink, toilet, etc.)

Milestones:

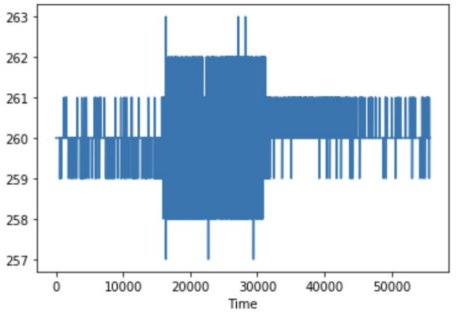
1. Proof of Concept: can we detect water?
2. Light up LEDs corresponding to different appliances
3. Communicate with a computer for more powerful computations
4. Realized implementation with leak detection

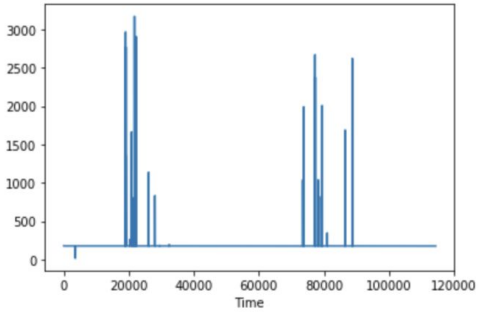
Milestone 1

Proof of Concept: Can the vibration sensors pick up water moving through the pipe?



- Used ceramic piezo vibration sensor and ADC
- Initial results were exciting
  - Able to see some changes when water is used
  - Plastic pipe results better than copper
- Not sensitive enough
  - Difficult to differentiate sink, tub, toilet, etc.
  - 12 bit ADC resolution still was not enough

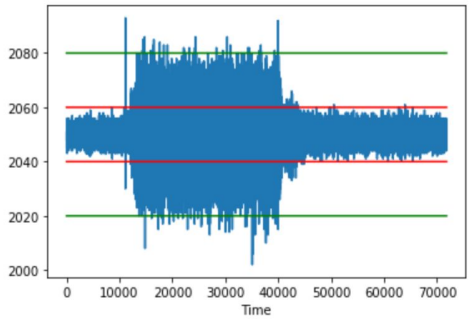


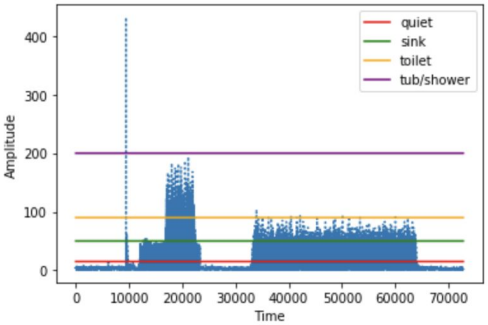


Milestone 2

Identify the passage of water for certain use cases and indicate via LEDs

- Switched from vibration sensor to microphone
  - Much easier to detect different use cases
  - Better quality results
  - More susceptible to environment noise
- LEDs
  - Thresholds to enable LEDs
    - Sink, Toilet, Tub, Other/Multiple

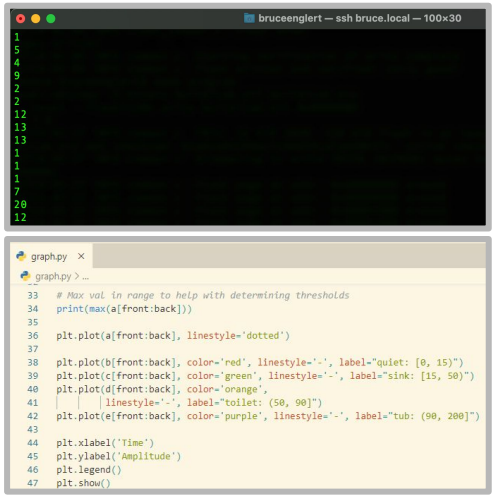


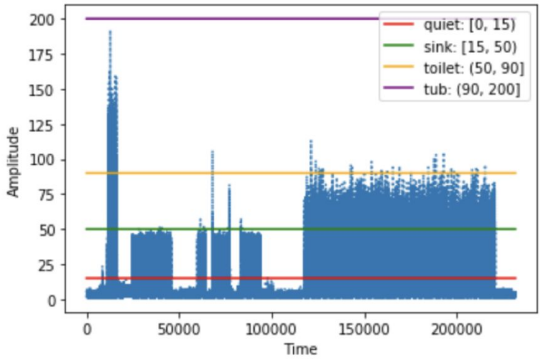


Milestone 3

Output useful data to an external processor for more in-depth computations

- UART for communication with laptop (one line per reading)
- Python script to parse UART data into graphs



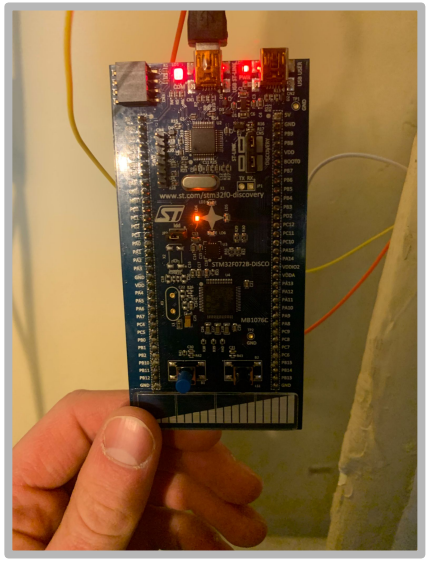


Milestone 4

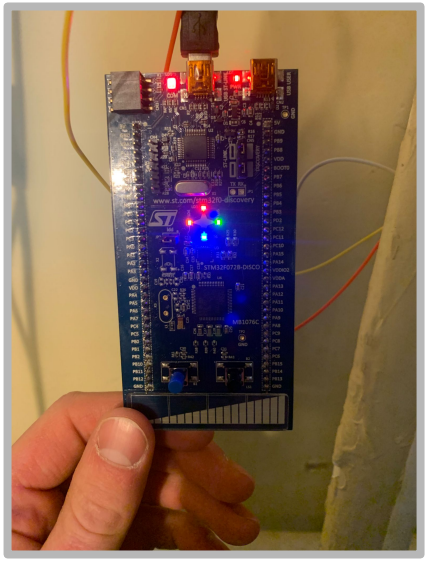
Realized implementation that can associate behaviors, make educated decisions, and interact with the user

- Knowing which appliance is running
  - Green: Sink
  - Orange: Toilet
  - Red: Tub
  - Blue: Other / Multiple
- Detecting a leak
  - All LEDs turn on to warn user

Toilet Detected

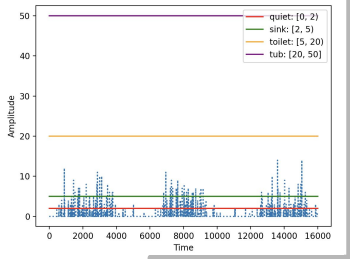


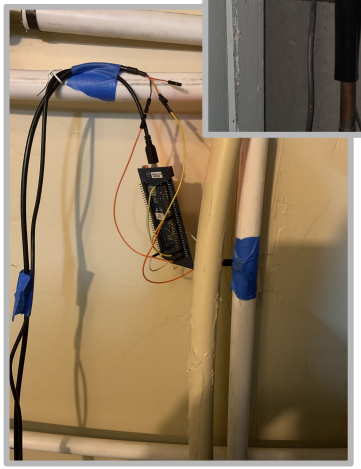
Leak Detected

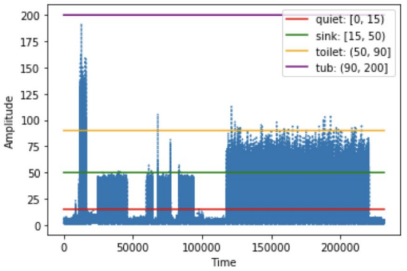


Conclusion & Future Plans

- Plastic pipe had better results than copper
  - Louder pipe = better sensing
- Environmental noise caused problems
- Vibration sensing not effective



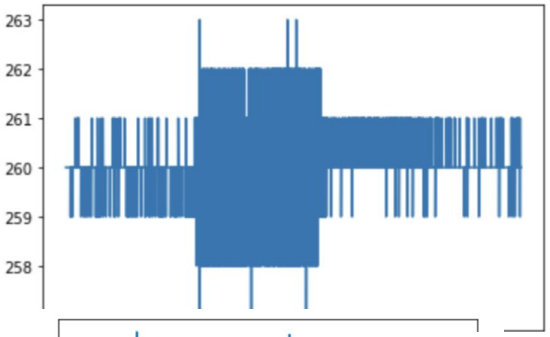


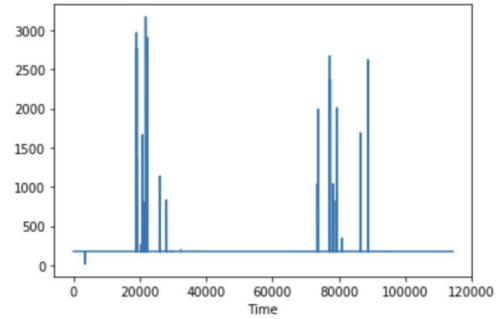


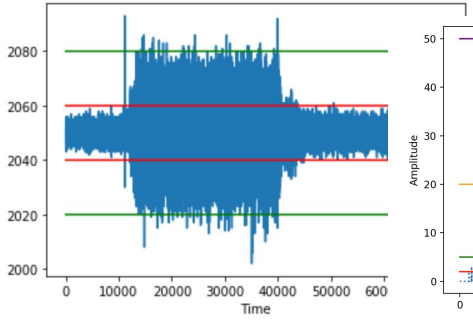
Future Plans:

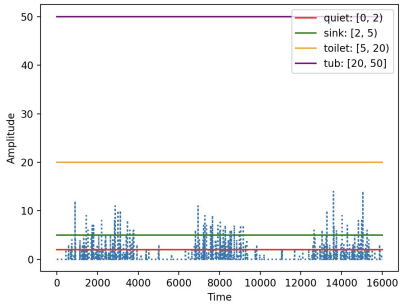
- Better user experience
  - WiFi connectivity
  - Web application
  - IoT integration (Google Home, etc.)
- Improve accuracy
  - Change behavior based on material
  - Allow user calibration

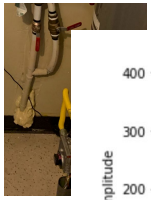
Thank You!

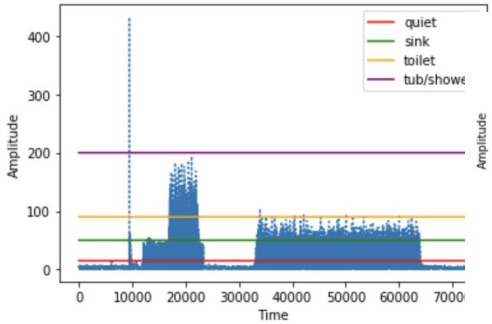


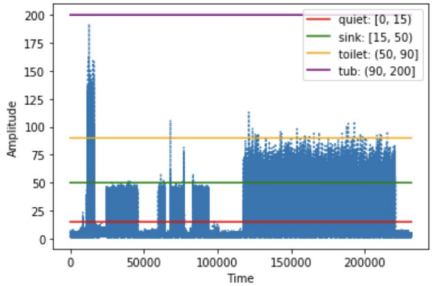












Comimark 1Pcs ADMP401 MEMS Microphone Breakout Module Board for Arduino Universal 1.3cm1cm

HiLetgo 2pcs 801S Vibration Sensor Module Vibration Model Analog Output Adjustable Sensitivity(Main chip: LM393)

MakerHawk 4pcs Analog Ceramic Piezo Vibration Sensor Module 3.3V/5V for Arduino DIY Kit