PinPoint - Clap Detector and Locator

Tommy Le (CSE), Kevin Wong (CSE), Steven Long (CpE), Joseph Tran (CSE)
Professor Lee Swindlehurst
Department of Electrical Engineering and Computer Science

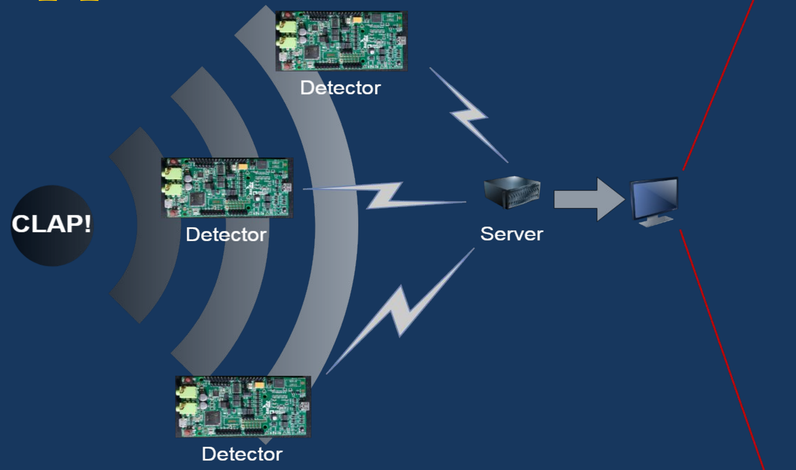
Project Description

PinPoint is a low-cost and low-power clap detection and locating system. Designed using two Analog Devices Blackfin DSP and two Raspberry Pi W in a mesh/client-server configuration allows for wide-area clap detection and location. The Blackfin DSP dedicates its full compute power towards analysing claps, while the Raspberry Pi W handles connectivity and server interfacing.

Goals

- Detect claps:
  - over voice
  - with loud background noise
  - from similar sounds (loud, short sounds)
- Detection time to be less than one second
- Give estimate location of detected claps
- Infrastructure that can accommodate multiple detector nodes

Approach



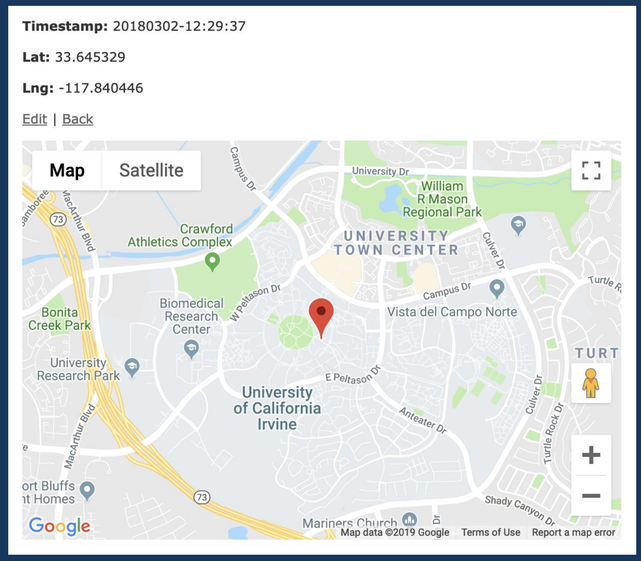


Figure 1. Location of an alert marked onto Google Maps (test data)

Success

- Detected claps within noise:
  - Human voice
  - Loud environment
- Dynamic thresholds to detect clap
- DSP to Raspberry Pi W 4-bit parallel interfacing
- Client-server infrastructure established

Challenges

- Narrowing the direction of the noise source due to environmental noise floor
- Distance measurements due to varying environments
- Hardware integration across different systems
- Distinguish claps from other loud, short sounds

References

[1] Kovachev, D. (2019). LM358 microphone amplifier. [online] Low voltage. Mostly harmless... Available at: https://lowvoltage.wordpress.com/2011/05/21/lm358-mic-amp/ [Accessed 4 Mar. 2019].
[2] Repp, B. (1986). The sound of two hands clapping: An exploratory study. [online] Haskins.yale.edu. Available at: http://www.haskins.yale.edu/Reprints/HL0585.pdf [Accessed 2 Feb. 2019].
[3] J. Yang and P. Hilmes, "Dynamics and Periodicity Based Multirate Fast Transient-Sound Detection," 2018 26th European Signal Processing Conference (EUSIPCO), Rome, 2018, pp. 2449-2453.
[4] Croston B. Raspberry Pi GPIO Wiki. [online] Available at: https://sourceforge.net/p/raspberry-gpio-python/wiki/Home/ [Accessed 20 Feb. 2019]