Wireless Sensor Network Localization Quarter Recap

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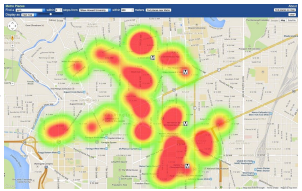
3/11

Project overview

- Sensor data (sound, temperature, etc.) is most useful when localized.

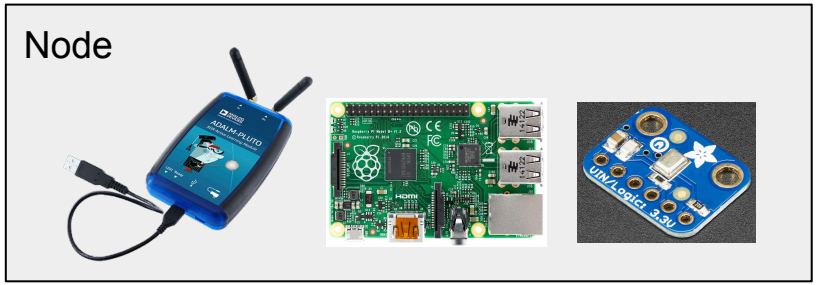
Sensor	Value
A	255
B	124
…	…

→ Localization →



- Most localization techniques require additional hardware (e.g., GPS modules) that add to system SWaP-C.
  - The ideal solution would add no hardware to an existing sensor network.
- Goal: Create full system of Pluto-based sensor network + localization
  - Will be measuring and visualizing noise levels

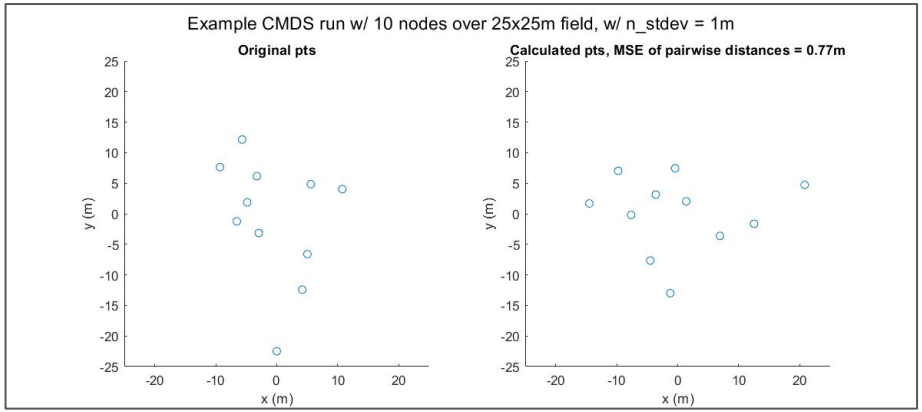
Approach



- HW:
  - Pluto SDR - Have qty 3
    - Already have 3 units for minimum viable prototyping
    - Leaves door open for frequency-varying techniques not available on e.g. BLE chipsets
    - Has built-in FPGA for small-scale hw acceleration
  - Adafruit I2S MEMS Microphone Breakout - Qty 5 on order
    - Sound sensor, I2S interface
  - Raspberry Pi 3B - Have qty 3
    - Interface between Pluto and sound sensor
- SW:
  - Localization is composed of 2 high-level pieces:
    - Per-link distance measurements
      - I.e., the distance between each pair of nodes
      - Chose ToF and RSSI as dual measurements
    - Network shape synthesis
      - Combine per-link measurements to reconstruct overall node arrangement
      - Chose multi-dimensional scaling as algorithm of choice
  - Network layer
    - Charon: open source mesh network software
      - Layer 1: OFDM, liquidSDR library
      - Layer 2: BATMAN-adv

Results

- Simulation:
  - Validated choice of multi-dimensional scaling as synthesis algorithm
  - Showed that noisy link measurement of ±1m (so 99.7% < 3m) causes manageable MSE
    - So target goal of link accuracy is maximum 3 m error



- Testbench:
  - Began characterizing RSSI-to-distance relationship

Schedule

- Overall summary: on schedule
  - Specs, architecture, sims, testbed all complete
  - Now just onto experimentation, final implementation, testing