CS HONORS UNDERGRADUATE RESEARCH PROGRAM - PROJECT CHECKPOINT TALK

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OVERVIEW OF PROJECT

- It's hard to figure out where exactly motes are, but the ENSBox platform has mostly solved this with the ability to localize its own nodes and other acoustic sources.

- The purpose of my research is to integrate motes into the ENSBox system to:
  - use ENSBox as means to localize motes
  - have a mote network trade information with boxes
  - (potentially have mote network help in acoustic localization)
BREAKDOWN OF STEPS, BOTTOM UP

1. Single ensbox:
   - Determines direction of arrival (DOA), likelihood vector
     - Using an approximate maximum likelihood (AML) algorithm

2. Many ensboxes:
   - Determines position of a mote
     - Using likelihood vectors for each ensbox, and with known ensbox positions

3. Many motes w/ known positions:
   - A mote network with all nodes with known positions
EXAMPLE OF AML'S LIKELIHOOD VECTOR

A Visual Representation of a likelihood vector of a 2kHz call from about 5” away from microphone array

AML plotter made by Mike Allen
Fig. 13. A pseudo-likelihood map generated based on the log-likelihood of all nodes, taken from the compact deployment. Main lobes are denoted by small dark gray circle on the log-likelihood ring. Black dots points to the array zero degrees.

Source:
WHAT I’VE DONE

1. Single ensbox:  ➡️ Done
   - Determines direction of arrival (DOA), likelihood vector
     - Using an approximate maximum likelihood (AML) algorithm

2. Many ensboxes:
   - Determines position of a mote
     - Using likelihood vectors for each ensbox, and with known ensbox positions

3. Many motes w/ known positions:
   - A mote network with all nodes with known positions
WHAT I’VE DONE SO FAR

What I used:
- Existing ENSBox system
- Online AML
- AML Plotter

What I’ve done:
- Mote w/ Speaker
  - Emits chirp, ensbox produces likelihood vector
- Semi-automated
  - (currently broken)
WHERE I THOUGHT I WOULD BE BY CHECKPOINT

- ENSBox and single mote communicating
- Localize the single mote
  - Issue command at ENSBox to start process:
    - ENSBox tells mote to chirp
    - Mote chirps
    - ENSBoxes localize mote from chirp
  - Verify accuracy of ENSBox’s estimate
- Have started working on localizing multiple motes
  - includes making/borrowing mote network
WHY I’M NOT WHERE I THOUGHT I’D BE

- Difficulty
  - Learning curve to developing code
    - For Emstar and for TinyOS (nesC)
  - ENSBox platform, AML, etc. is a complicated system
  - “I’ll discover the requirements as I go along”
- Other commitments

- But also...
  - My original goals for checkpoint: weren’t realistic
WHAT MORE I EXPECT TO DO

- Find a good chirp
  - Pure tone or pattern, what frequency
- Find position of mote
  - merge AML likelihood vectors from several ensboxes
- Extend support for multiple motes
- Package everything into nice modules/libraries

Speculative Items:
- Mote network
  - establish a connection between motes and ensboxes