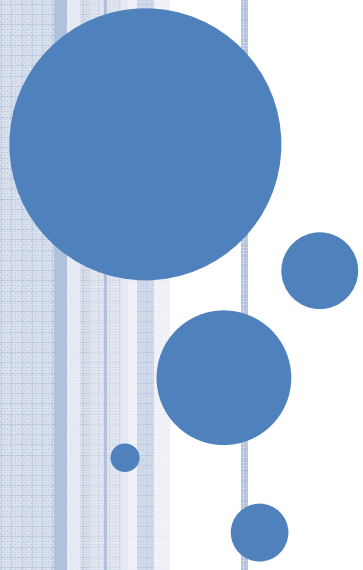

CS Honors Undergraduate Research Program - Project Checkpoint Talk

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Advisor: Professor Deborah Estrin

Date of Presentation: Friday, April 13, 2007

Overview of Project

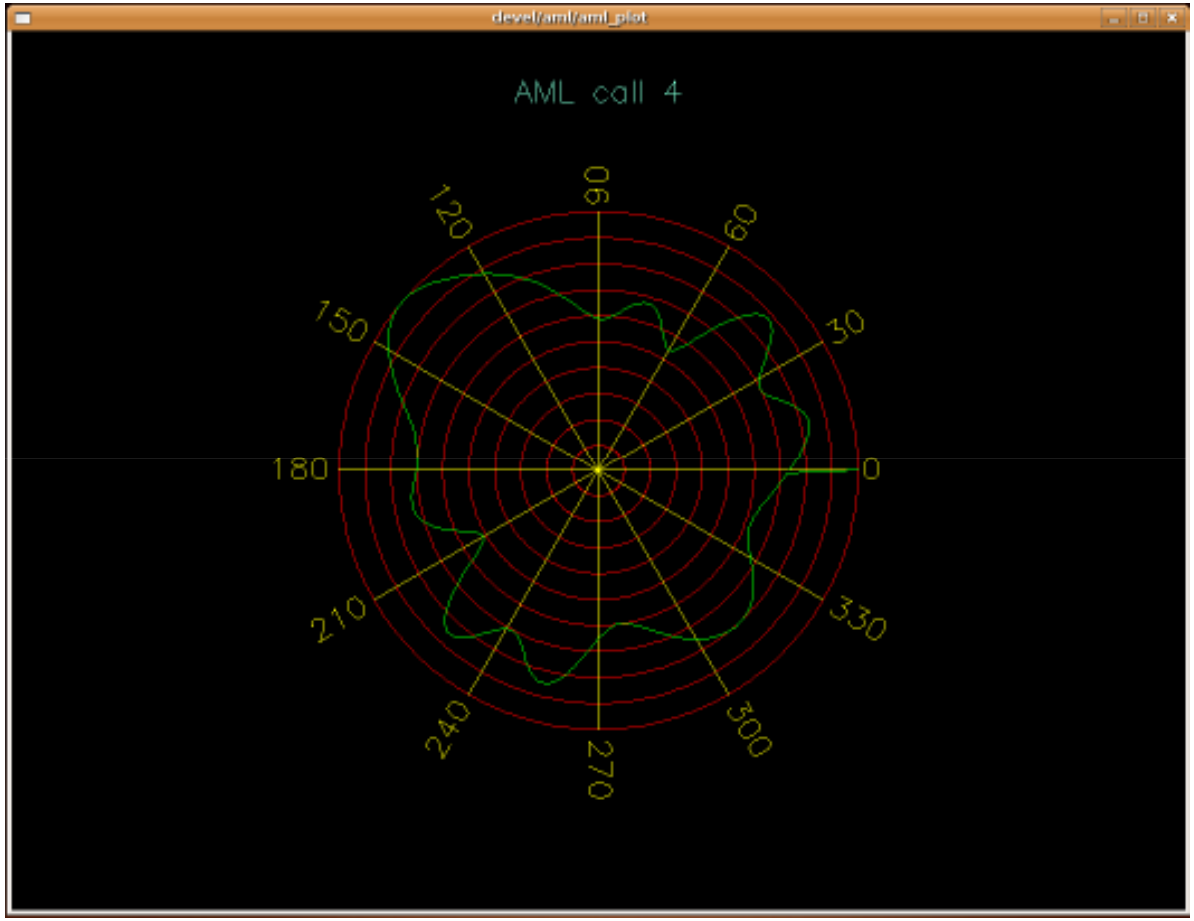
- It's hard to figure out where exactly motes are, but the ENSBox platform has mostly solved this with the ability to localize its own nodes and other acoustic sources.

- 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

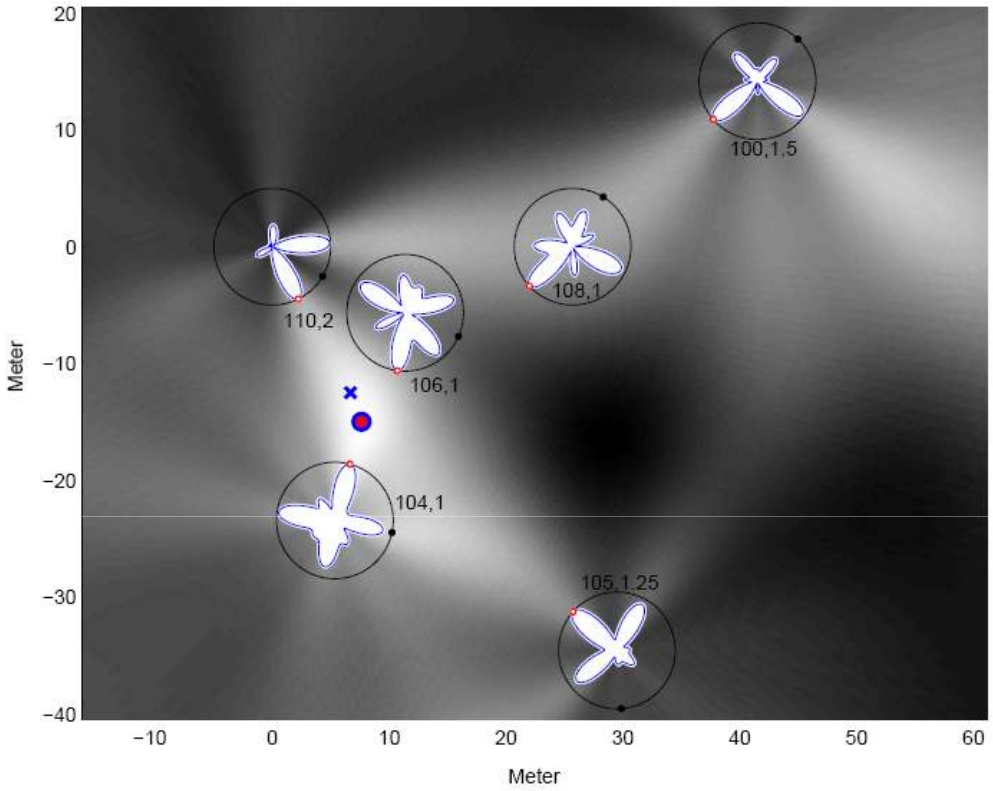


Fig. 13. A pseudo-likelihood map generated based on the log-likelihood of all nodes, taken from the compact deployment. Main lobes are denoted by small dark gray circle on the log-likelihood ring. Black dots points to the array zero degrees.

Source:

Ali, Andreas M., et al., “An Empirical Study of Collaborative Acoustic Source Localization,” for IPSN’07, 2007

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