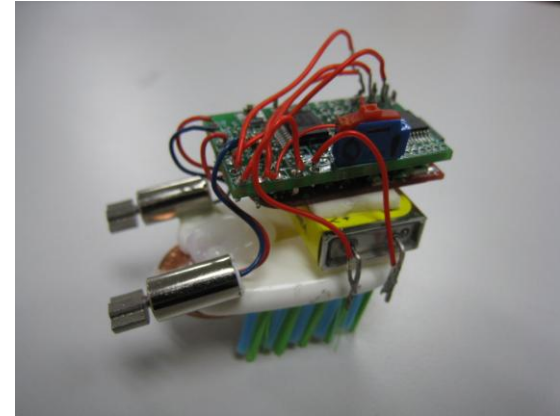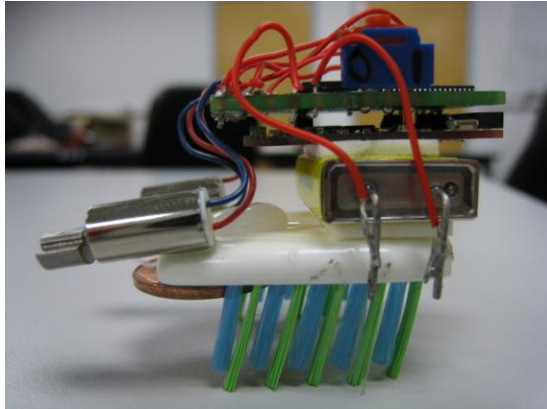# Control and Coordination of Micro-Robots

Lydia Lei and Christopher Perkins

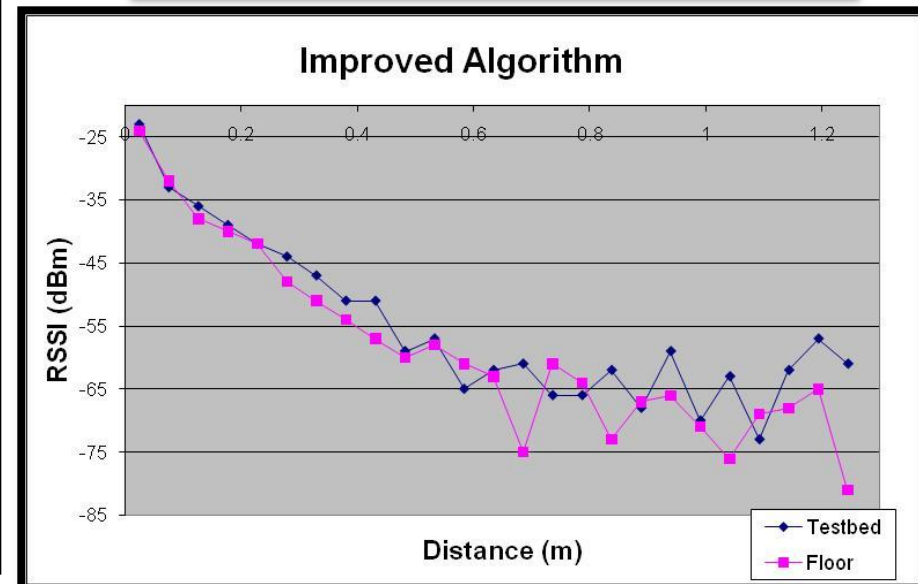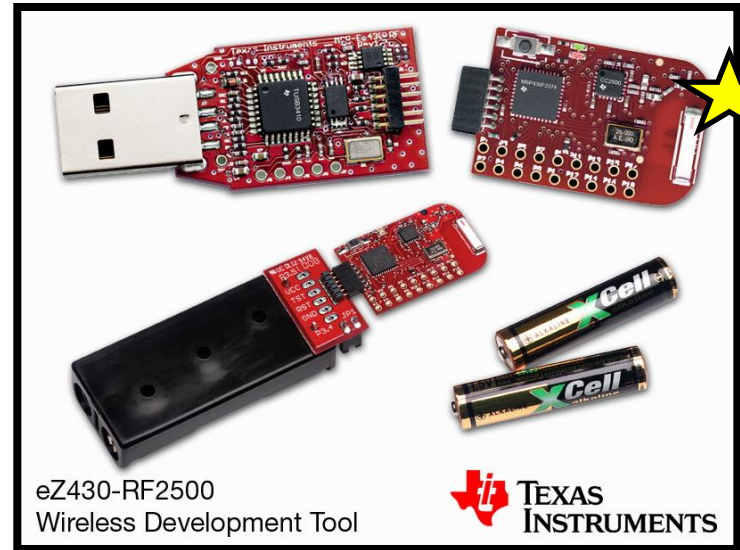Andy Turner, Timir Datta, Dave Sander

Dr. Pamela Abshire

The Problem:

– Access to denied environments (i.e. infrastructure, underground pipes)

– Need a coordinated swarm of robots

– Need to communicate and know where they are relative to other robots

Our Goal: The main goal this summer was to implement a reliable and accurate distance measurement algorithm onto individual robots.
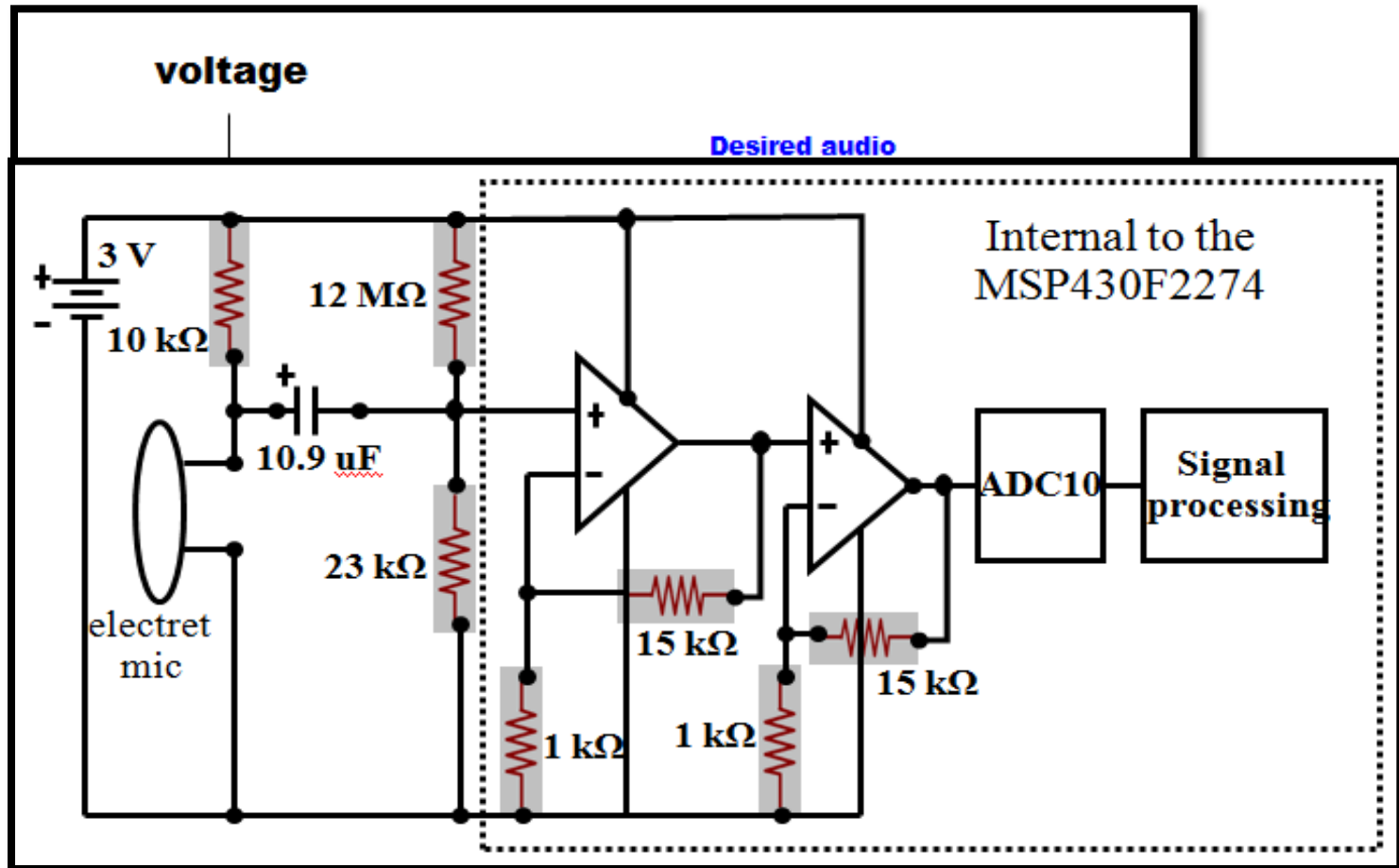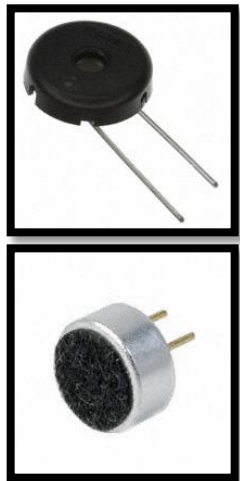
Methods

Received Signal Strength Indicator (RSSI)

- What is RSSI?
- Built in antennas in the eZ430-RF2500 TI board
- Problems with RSSI
  - Directivity
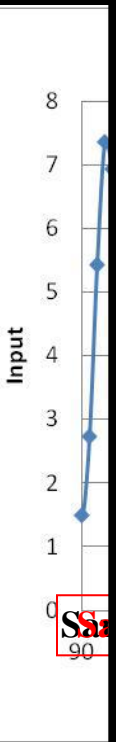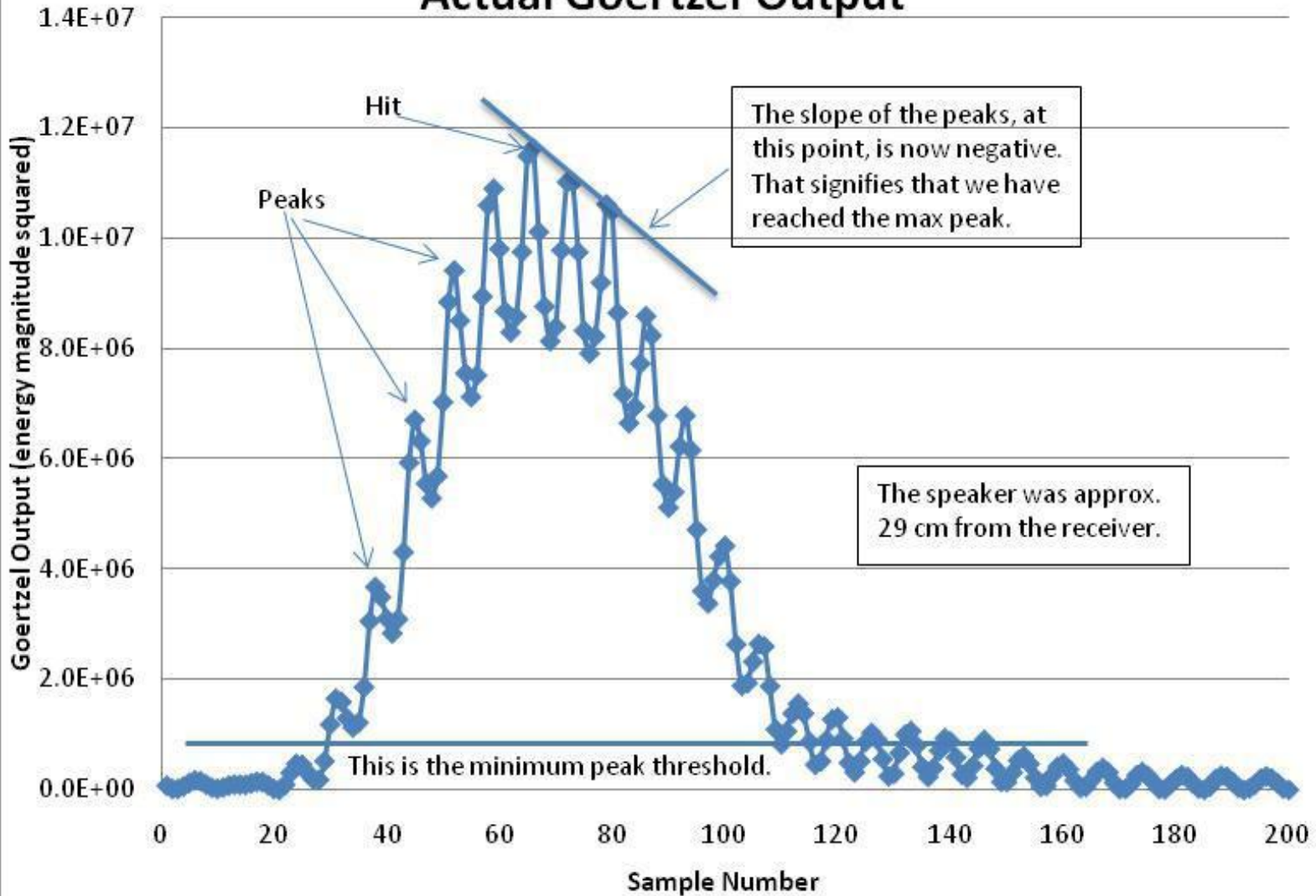 - Sensitive to environment
- Solution
  - TDOA

eZ430-RF2500
Wireless Development Tool

TEXAS INSTRUMENTS

Improved Algorithm

Distance (m)

RSSI (dBm)

— Testbed
— Floor

Methods

Time Difference of Arrival (TDOA)

- ## What is TDOA?

Actual Goertzel Output

Hit

The slope of the peaks, at this point, is now negative. That signifies that we have reached the max peak.

Peaks

The speaker was approx. 29 cm from the receiver.

This is the minimum peak threshold.
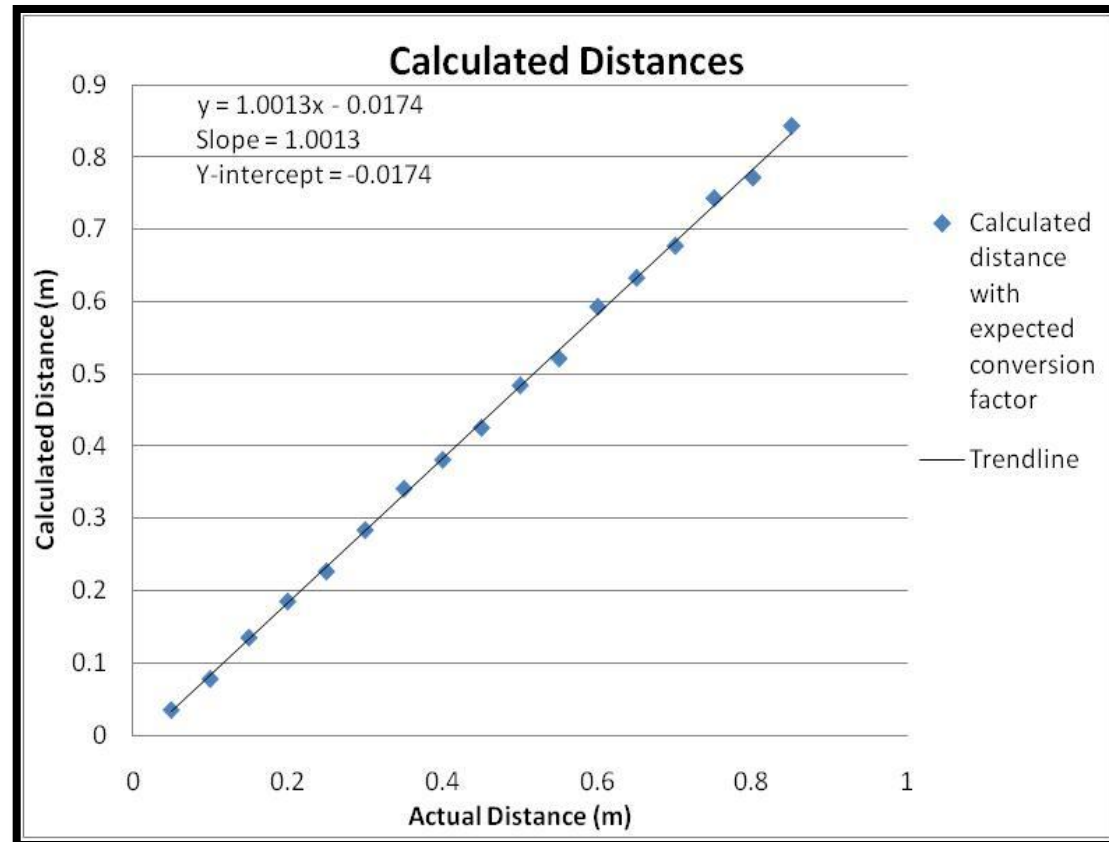
Time Difference of Arrival (TDOA)

- Accurate distance measurement

- Data monotonically increases

- Range of ~0.90 m

- Slope of trendline: 1.0013
    - Ideal slope: 1

- Percent error: 0.13%

Conclusion

- RSSI
  - Could be useful for close ranges (< 0.5 m)
  - No extra hardware
- TDOA
  - ~0.9 m range
  - Limitations of microprocessor
  - Code optimization
  - Successful proof of concept

Acknowledgments