

Kickoff slides
1/21

Wireless Sensor Network Localization on Pluto SDRs

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Background

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



- 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.
- Many different techniques for localization exist:

<https://sci-hubtw.hkvisa.net/10.1016/j.comnet.2006.11.018#>

Approach



- HW:
 - Given scheduling constraints + lead times, go with hardware on hand
 - Pluto is a fully capable (if cheap) SDR
 - 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
 - Should have enough antennas + batteries already, may need to order
- SW:
 - Simplest approaches involve synthesis of pairwise distance metrics (trilateration)
 - Measure individual links via RSSI, ToA, etc.
 - Combine using algorithm such as Multi-Dimensional Scaling, force-directed graphs, etc.
 - Other approaches (e.g. triangulation) require different hardware setups (e.g. MIMO)
 - Synthesis algorithm choice largely depends on constraints of hardware accuracy
 - Previous experience w/ MDS simulations, so will start from there
 - May need to change depending on how Pluto turns out
 - Existing work indicates it may be mediocre (± 2.5 m vs strict RSSI approach)
<https://digital.wpi.edu/pdfviewer/rf55zb40q>
 - Can try to improve on pairwise measurements via combination of different measurements
 - Mesh network protocol TBD, looks like existing solutions (e.g. IEEE 802.15.4) are publically available

Schedule

Category	Task	Quarter 1			Quarter 2		
		Jan	Feb	Mar	Apr	May	June
Project Management	Project scoping	■					
	Project approval by dept heads		■				
	Final presentation						■
Systems Engineering	Requirements analysis		■				
	System/Sub-System Specifications			■			
Development	Sensor evaluation		■				
	Pluto bringup			■			
	Link distance measurement			■	■		
	Algorithmic development (simulation)				■	■	
	Algorithmic implementation					■	
	Network setup				■	■	
Test and Evaluation	Small scale indoor tests (+ debug)					■	
	Large scale field tests (+ debug)						■

Open questions

- What sensor?
 - Lead time implications
- Accuracy goal?
 - Somewhat tied to operational reqts (and therefore sensor data)