RSSI as a Long-Term Localization Metric

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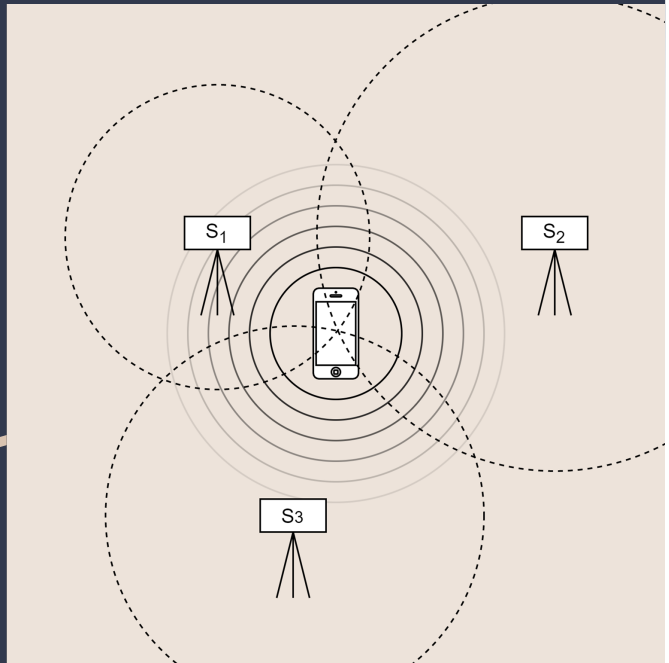
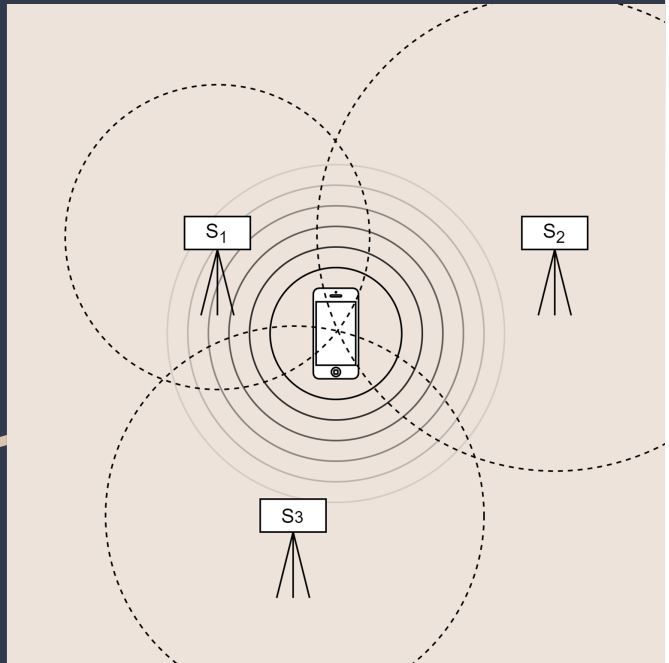
Context of the Problem



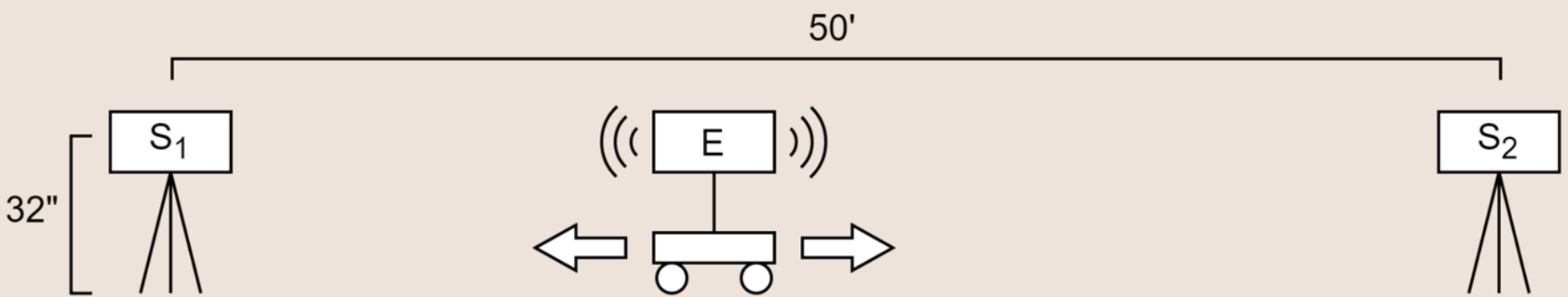
- Benefits of studying person movement
  - City planning and businesses
  - Navigation
  - Tourism and advertisement
  - Real estate
- How: mobility intelligence system [1]
  - Implementation issues - cameras
  - Use RSSI

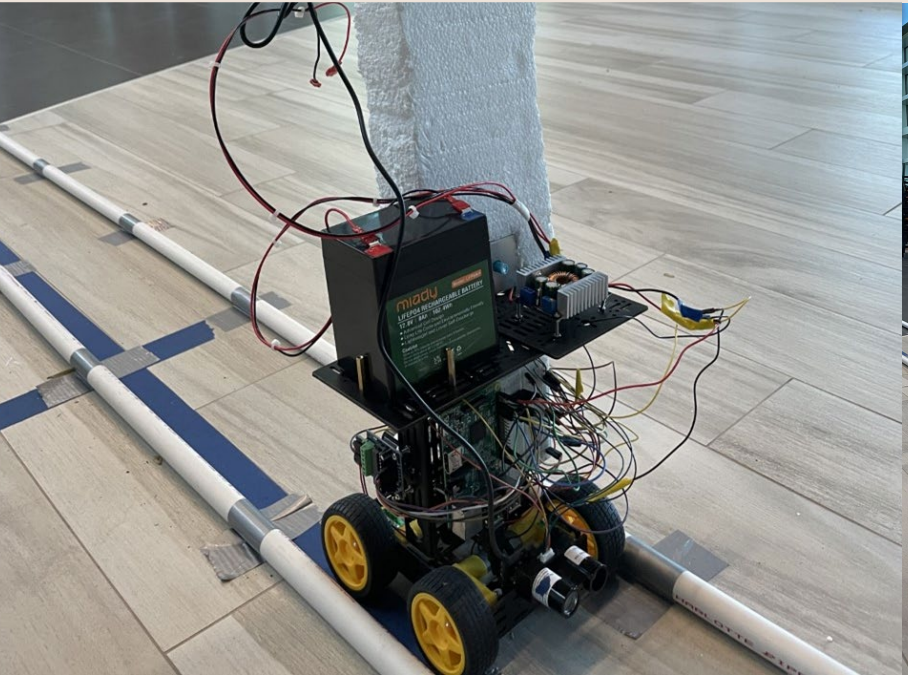
Our Contributions



- Research on RSSI is incomplete
  - Gap in long-term analysis [2]

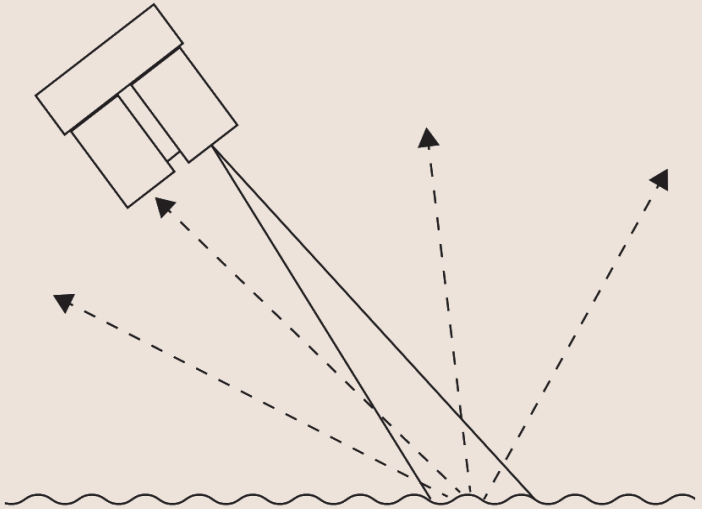
1. Collection of a large sample of RSSI data
2. Proof that models retain their accuracy
3. Analysis of RSSI’s limits
4. Distance-flexible models

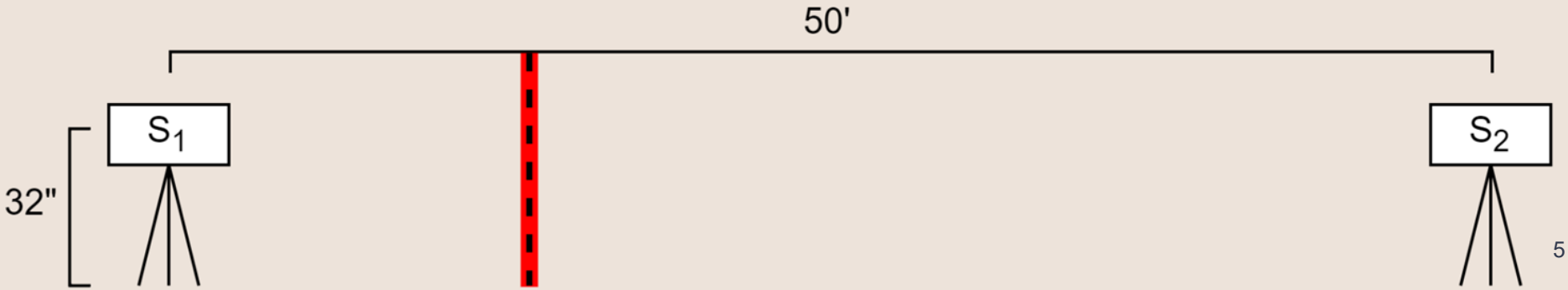

50'
S1
E
S2
32"



Ground Truth Evaluation

- Robotic platform finds its location with LiDAR optical distance sensors
- We conducted an experiment to measure the robot's accuracy
- Error less than 10 cm





Data Collection

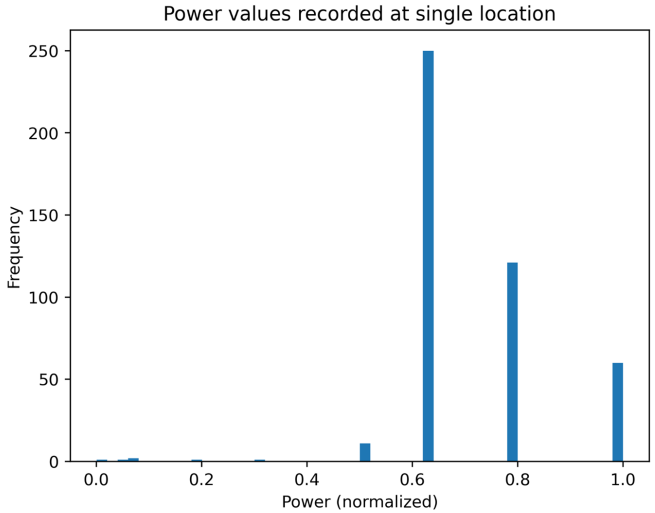
July

Su	Mo	Tu	We	Th	Fr	Sa
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

- Robotic platform ran 24/7
- 6 days for 30’ trial
- 11 days for 50’ trial
- Over 300 hours of data collection
- 35 million RSSI measurements

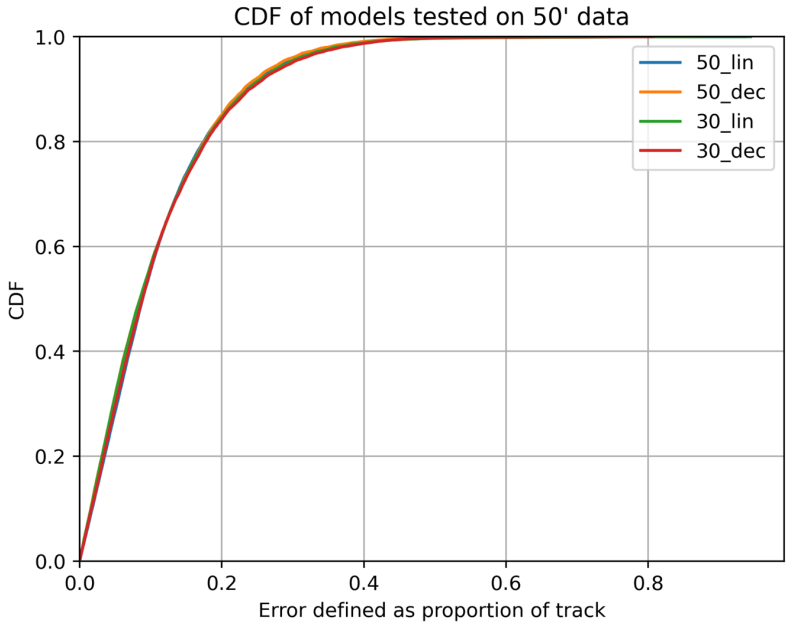
Data Processing

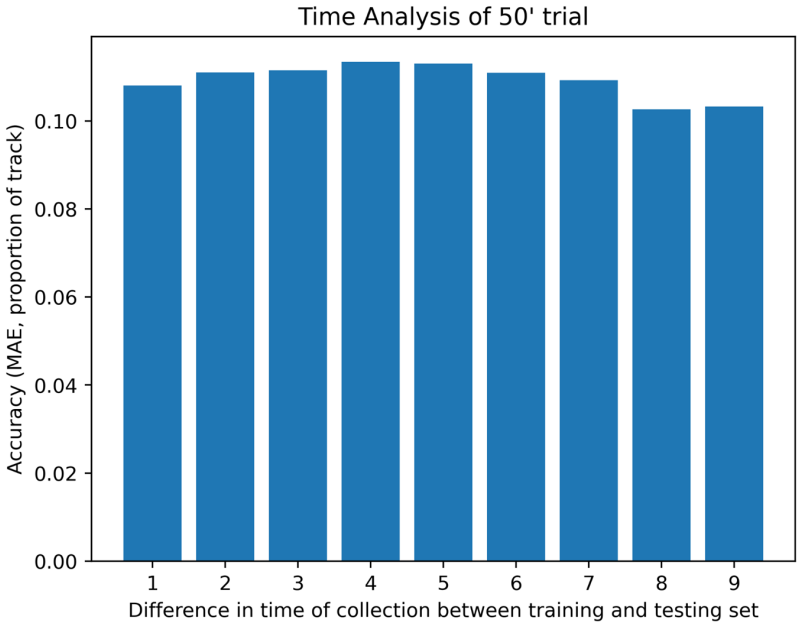
- Applied machine learning to data
  - Best performers: decision tree, linear regression
- Statistical analysis of data
  - Average coefficient of variation: 24%
  - Resolution error: 20 cm



Results

- Model accuracy doesn’t degrade over time
- Apply models at different distances



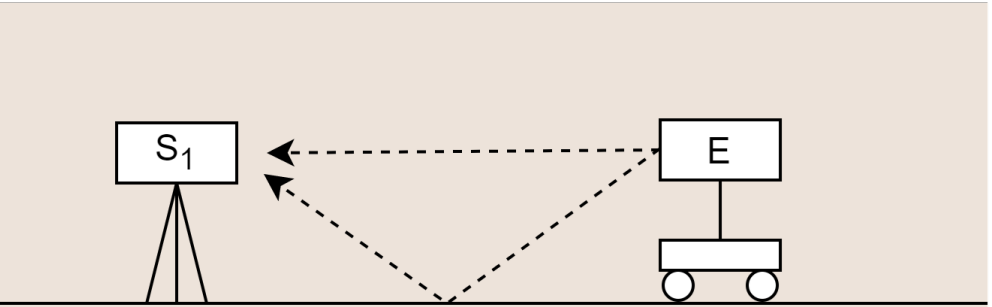


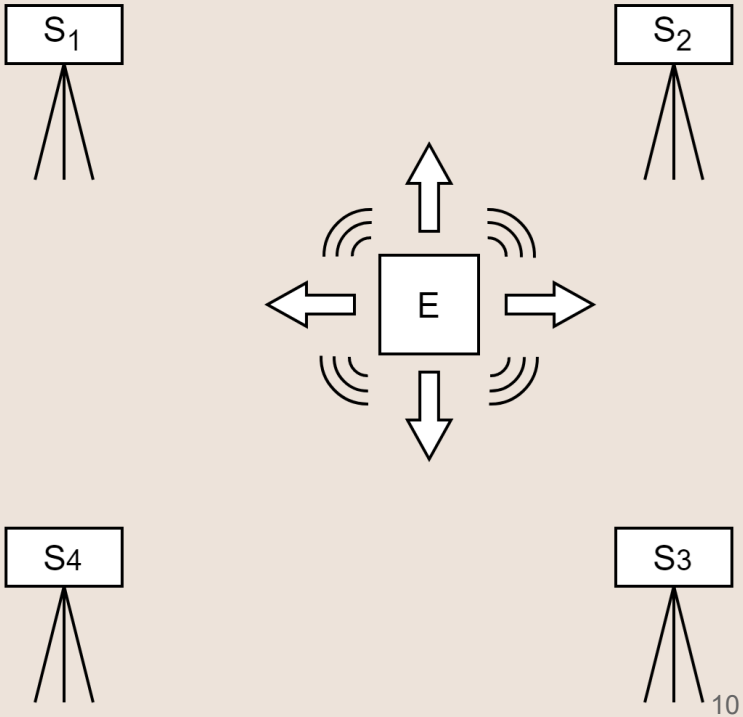
Key Takeaways

- Our models are stable enough to remain accurate over long periods of time
- We can train models at one distance between sensors, and apply them to another distance
- RSSI localization accuracy has an upper bound

Limitations and Future Work

- Tests were conducted in a close to ideal environment
- One-dimensional experiment meant that anisotropic antenna patterns had no impact





References

[1] S. Mazokha, F. Bao, J. Zhai, and J. O. Hallstrom, “Mobintel: Sensing and analytics infrastructure
for urban mobility intelligence,” in 2020 IEEE International Conference on Smart Computing (SMARTCOMP), 2020, pp. 106–113.

[2] F. Bao, S. Mazokha, and J. O. Hallstrom, “Mobintel: Passive outdoor localization via RSSI and machine learning,” Florida Atlantic University, 2020