SOICT School of Information Communication and Technology

MINI PROJECT

LOCATION ESTIMATOR WITH COMPASS ONLY

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1. INTRODUCTION

1. INTRODUCTION

Problem Statement

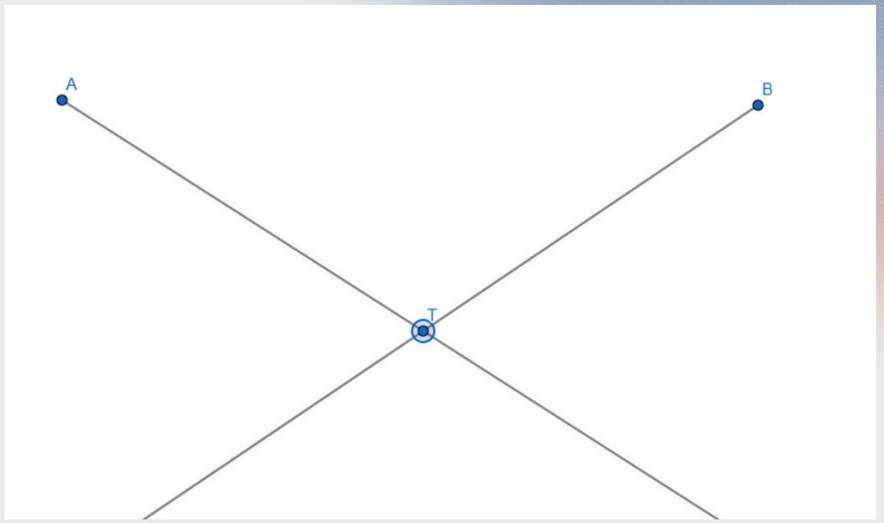
- Location Estimating is a common practical problem in both civil and military fields.
- This problem is solved with high accuracy with GNSS (Global Navigation Satellite System).
- In some extream cases, GNSS is not available and a compass is the only equipment.

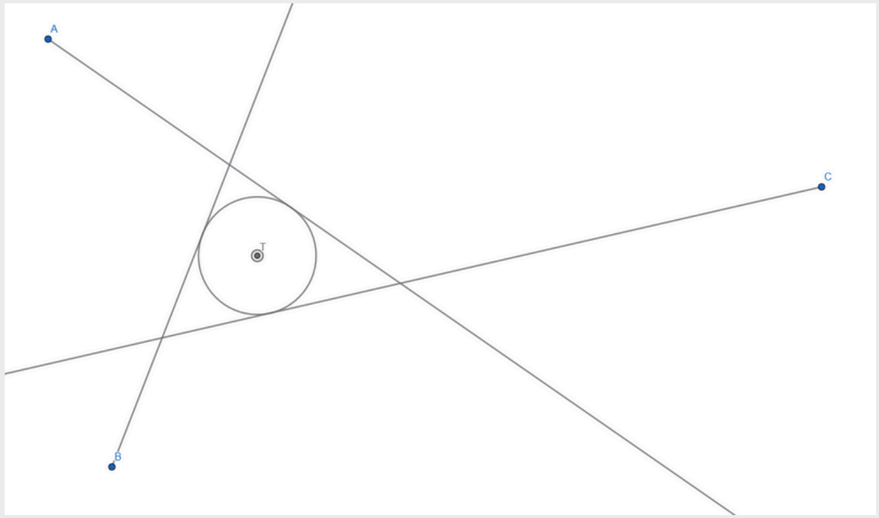
1. INTRODUCTION

Current Approach

- The well-known classical approach for this situation is geometrical approach.

- This approach have 2 limits:
  + Limited anchors (2 or 3).
  + Not considering noises and bias (from both anchors and bearings).





2. METHODS

2.METHODS

Least Error Estimator

- An expansion of classical geometric approach
- Allows an arbitrary number of anchors
- Inherited drawbacks: Not considers noises and bias

- Loss: sum of L2 distant from a point to 5 lines (defined by position of anchors and bearings)

$$\mathcal{L}(T) = \sum_{i \in anchors} d(T, l_i)$$

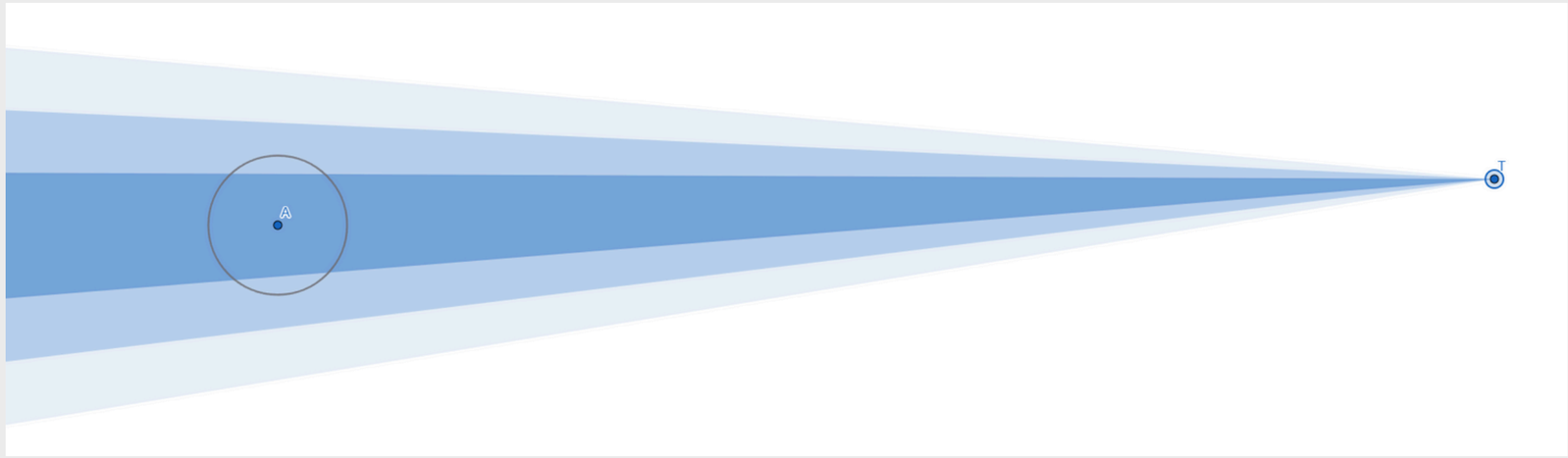
2. METHODS

Maximum Likelihood Estimator

- Allows an arbitrary number of anchors.
- Considers:
  + Noise of anchors
  + Noise and Bias of bearing measurements

- Loss: sum of log likelihood of the measurements given parameters.

$$\mathcal{L}(T) = \sum_{i \in anchors} -\log\left(L(\phi_i | x_T, y_T, b)\right)$$



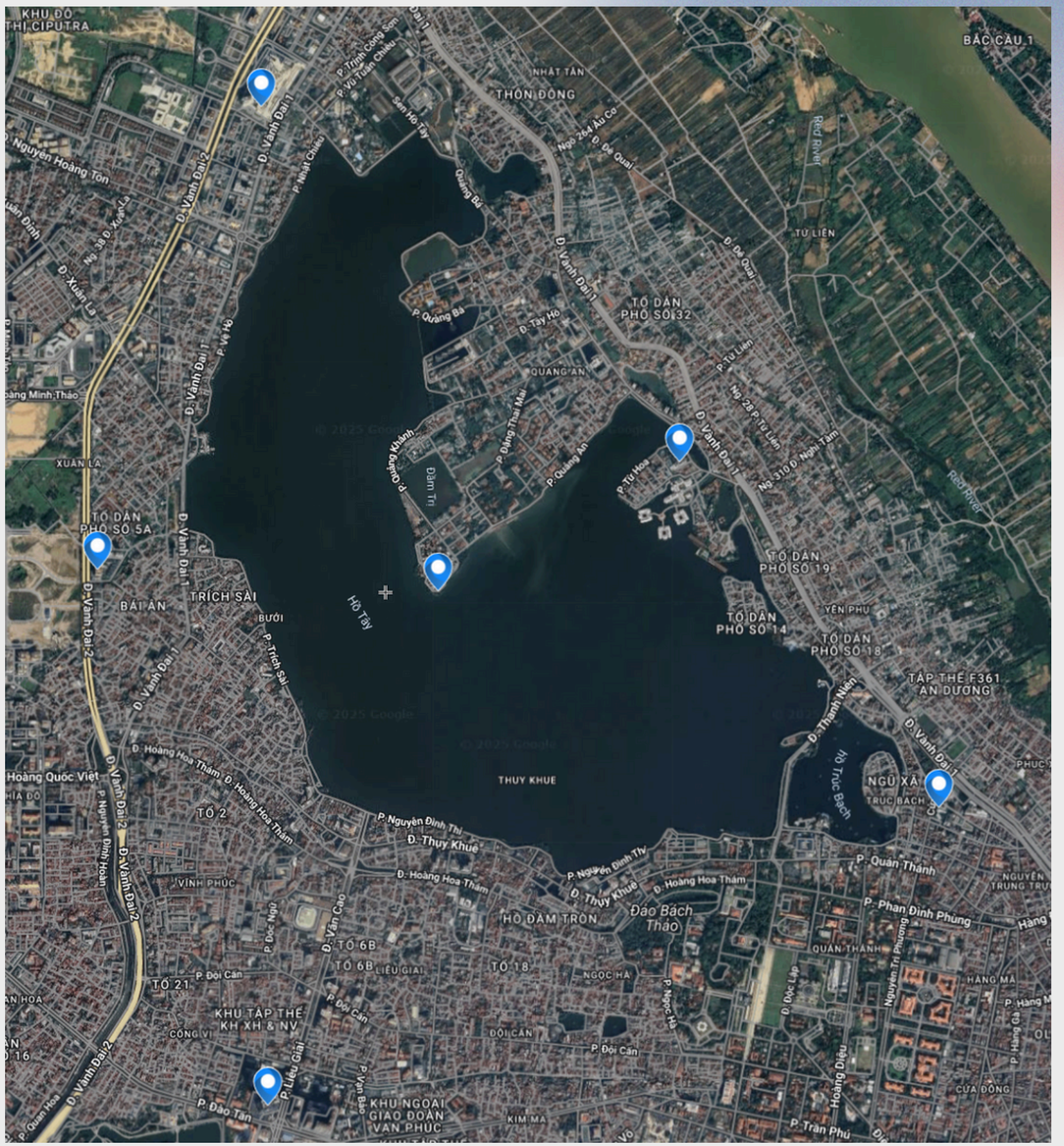
3. RESULTS

3. RESULT

Example Used For Simulation

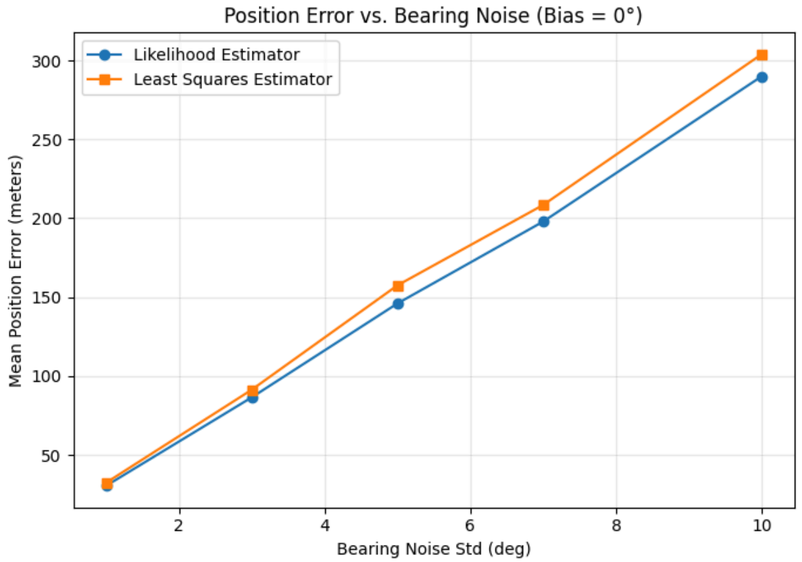
- The well-known classical approach for this situation is geometrical approach.

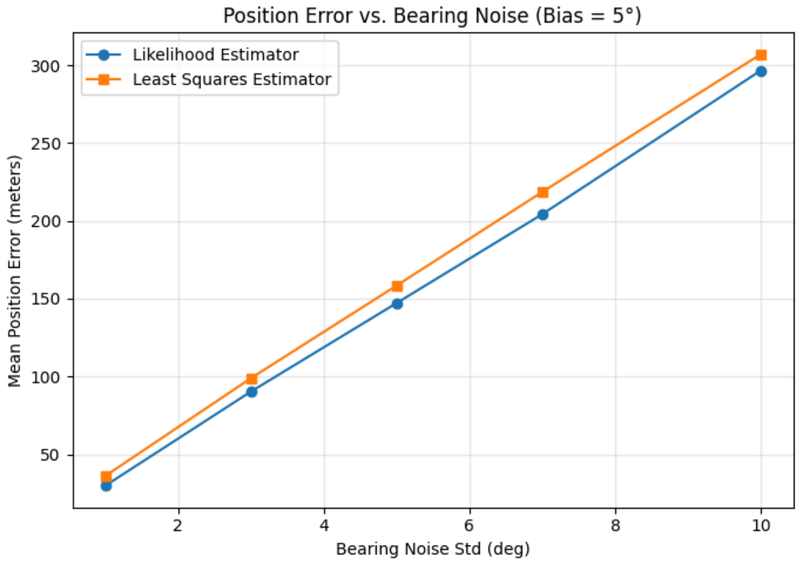
- This approach have 2 limits:
  + Limited anchors (2 or 3).
  + Not considering noises and bias (from both anchors and bearings).

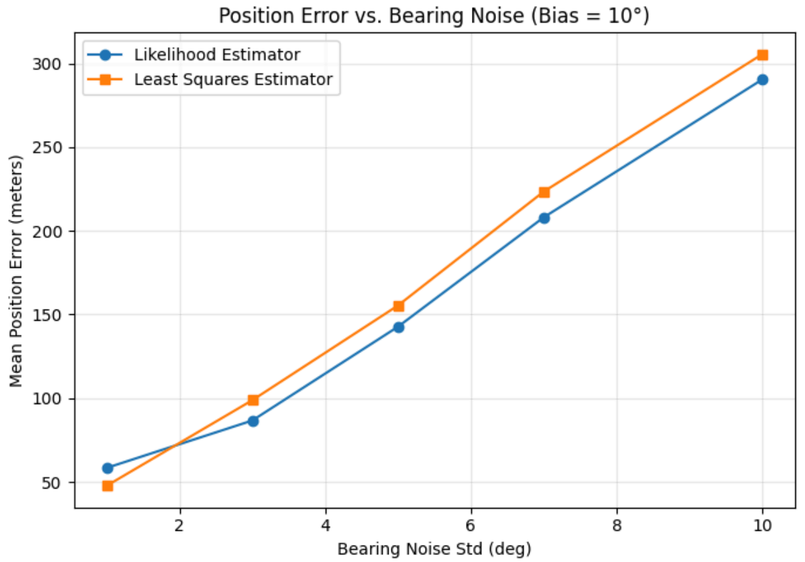


3. RESULT

Results







- In most cases, the Likelihood Estimator have lower Mean Position Error.
- In realistic case (3° of standard deviation in bearing noise), the Mean Position Error is under 100m.

4. CONCLUSION

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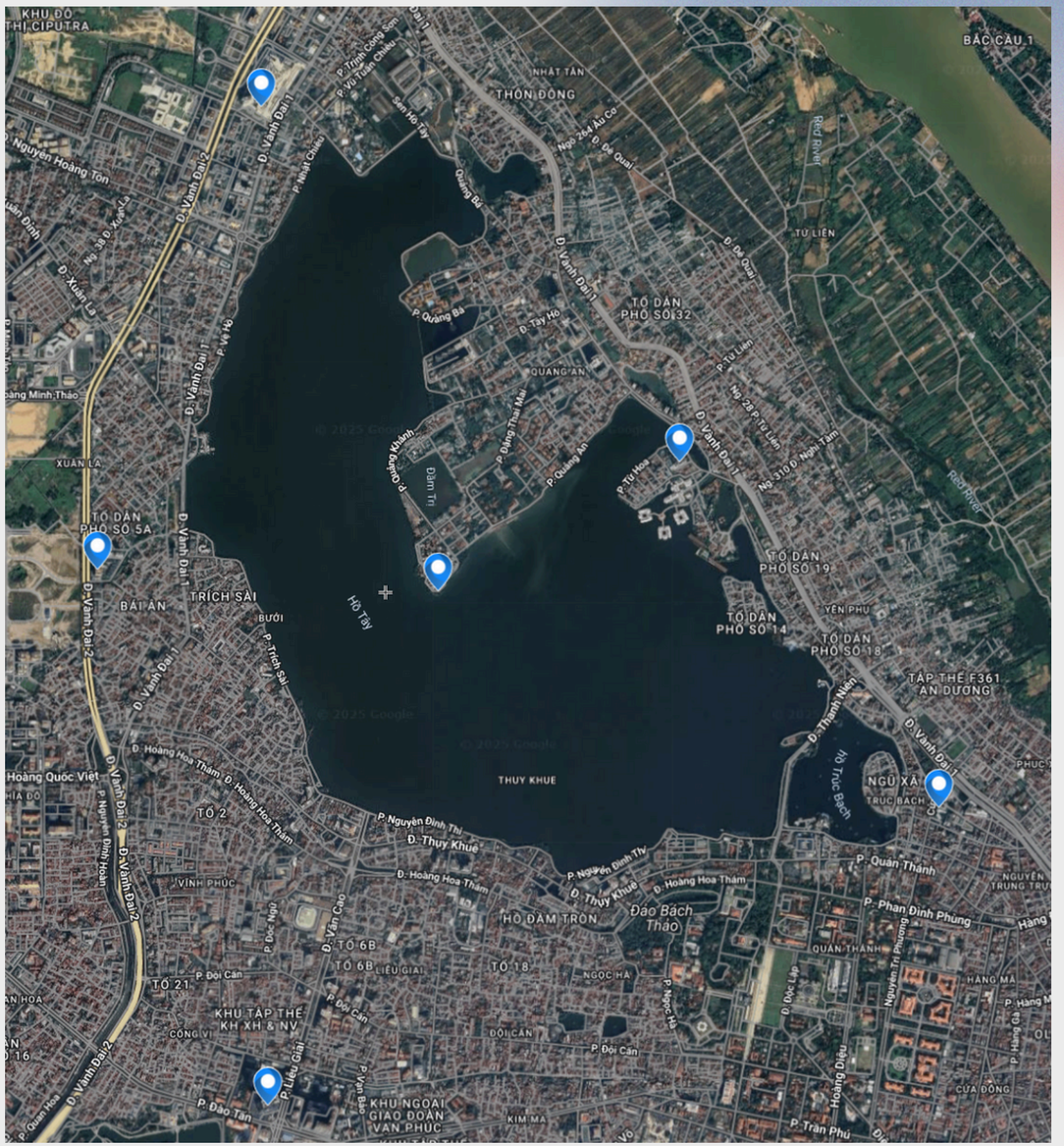
Conclusion

- With minimal equipment, the methods allows location estimation with not too bad accuracy.

Future Works

- We are working on a deeplearning models for MLE methods that might surpass current hand-crafted estimators.



THANK YOU!