Ad-hoc Localization in Urban District
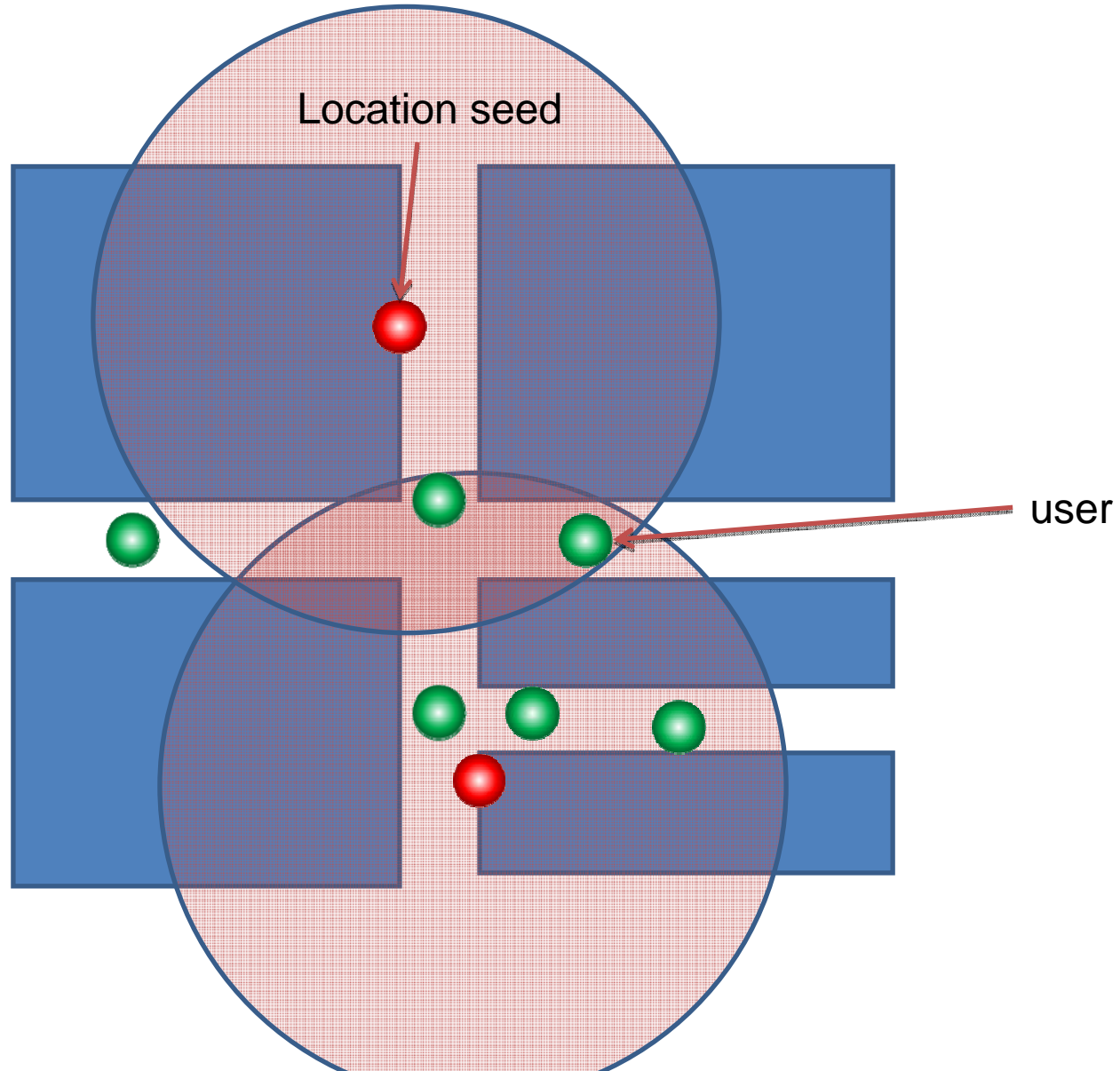
IEEE INFOCOM 2007

Present: Chih-Kai Wang
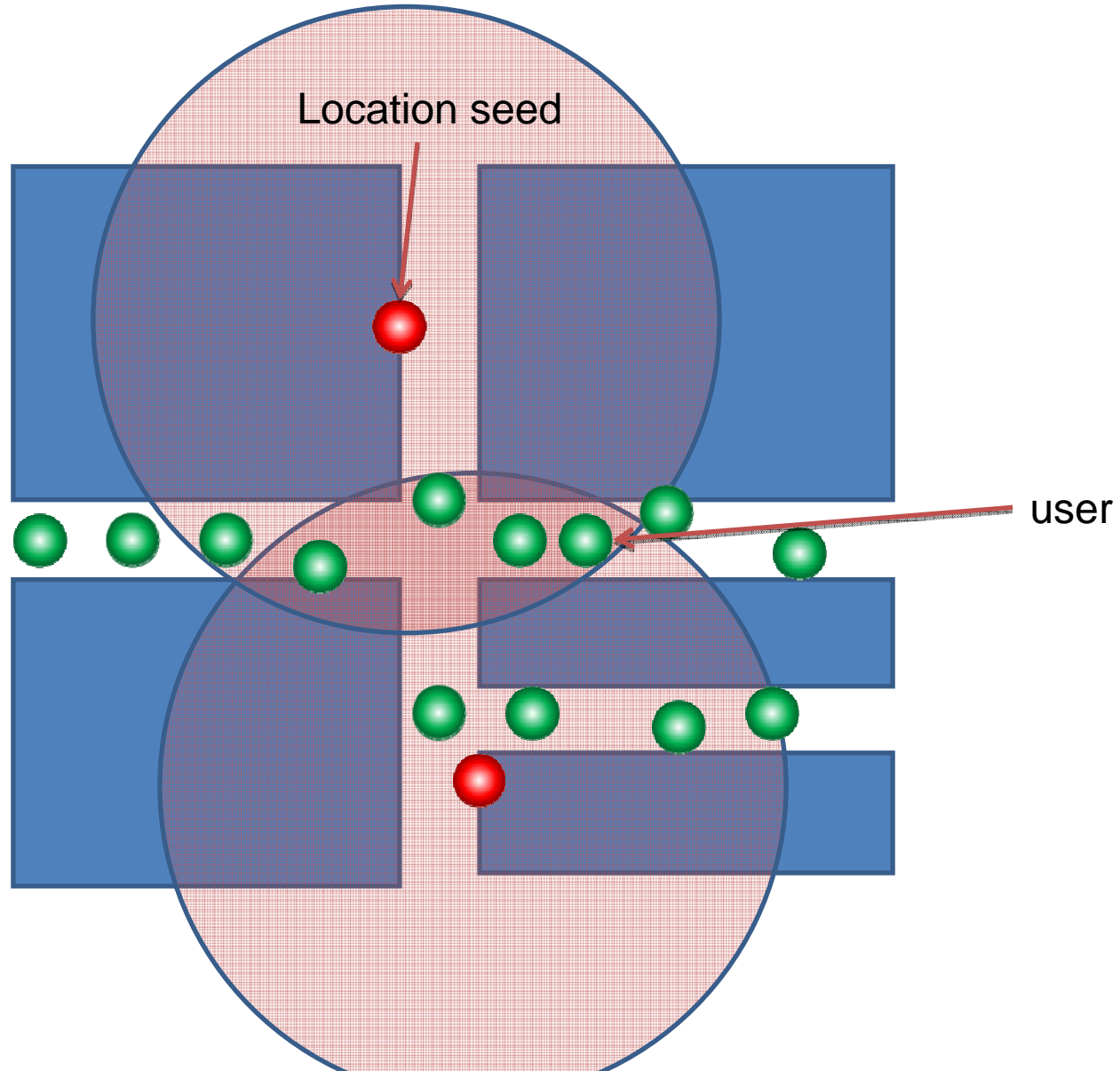
Outline

- Introduction
- Urban Pedestrians Localization Overview
- Algorithm details
- Simulation
- Conclusion

Introduction
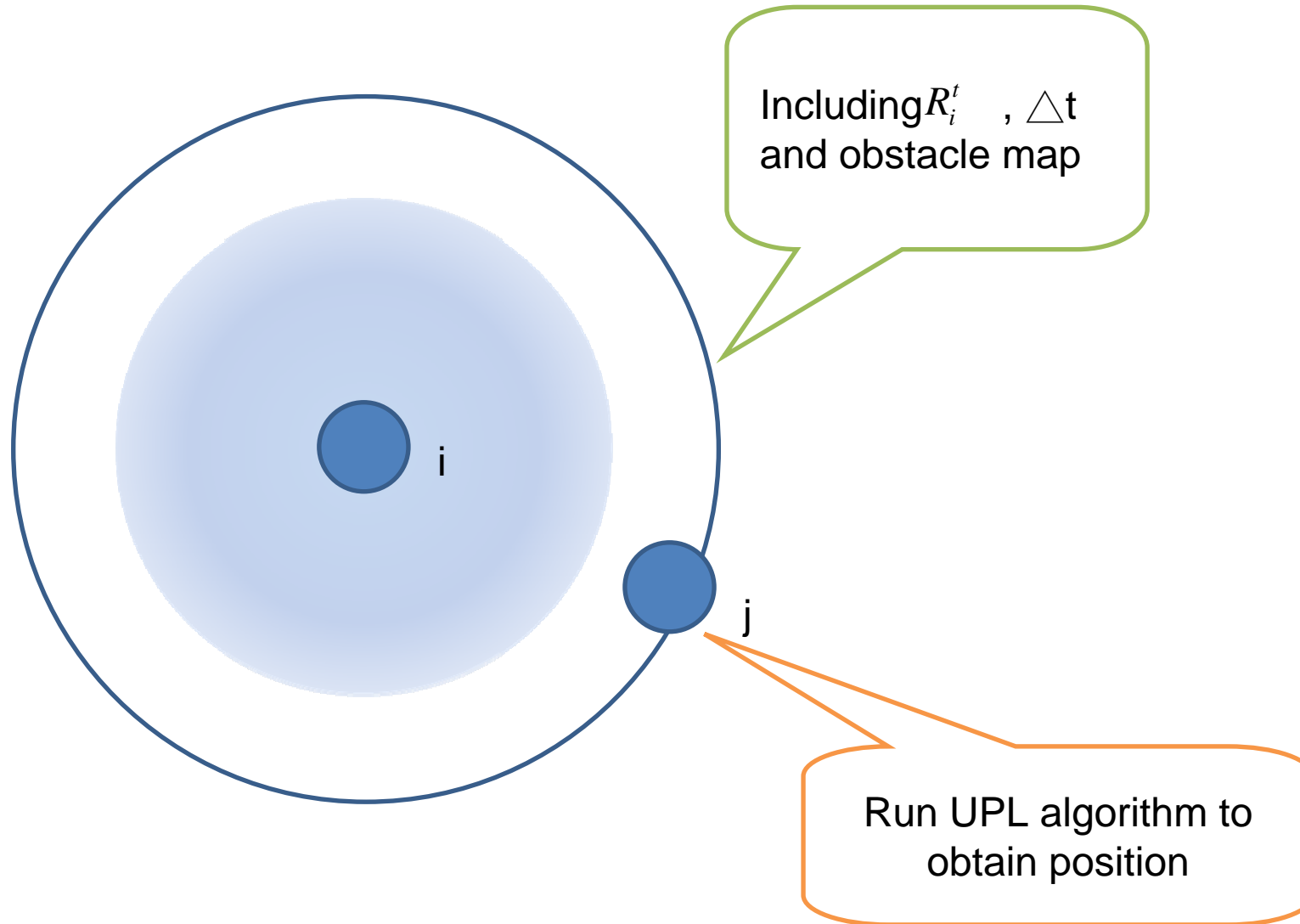

Location seed

user

Introduction

Urban Pedestrians Localization Overview

- Each node id equipped with a personal area communication.

- Assume:

  - The same communication range r for all nodes.

  - The same maximum velocity $Vmax$ for all the R_i^t nodes

- $\quad$ denotes an estimated area of presence(area of presence for simple)
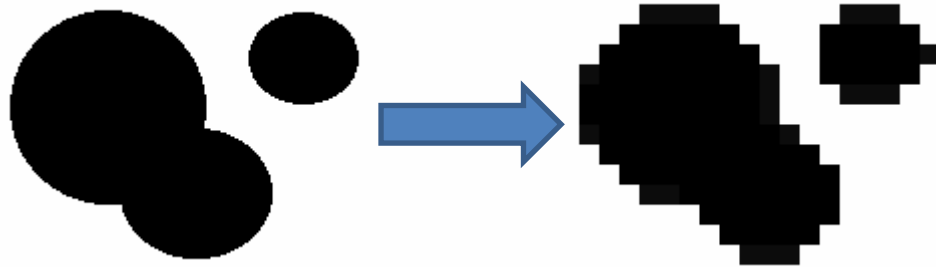
Urban Pedestrians Localization Overview

Urban Pedestrians Localization Overview
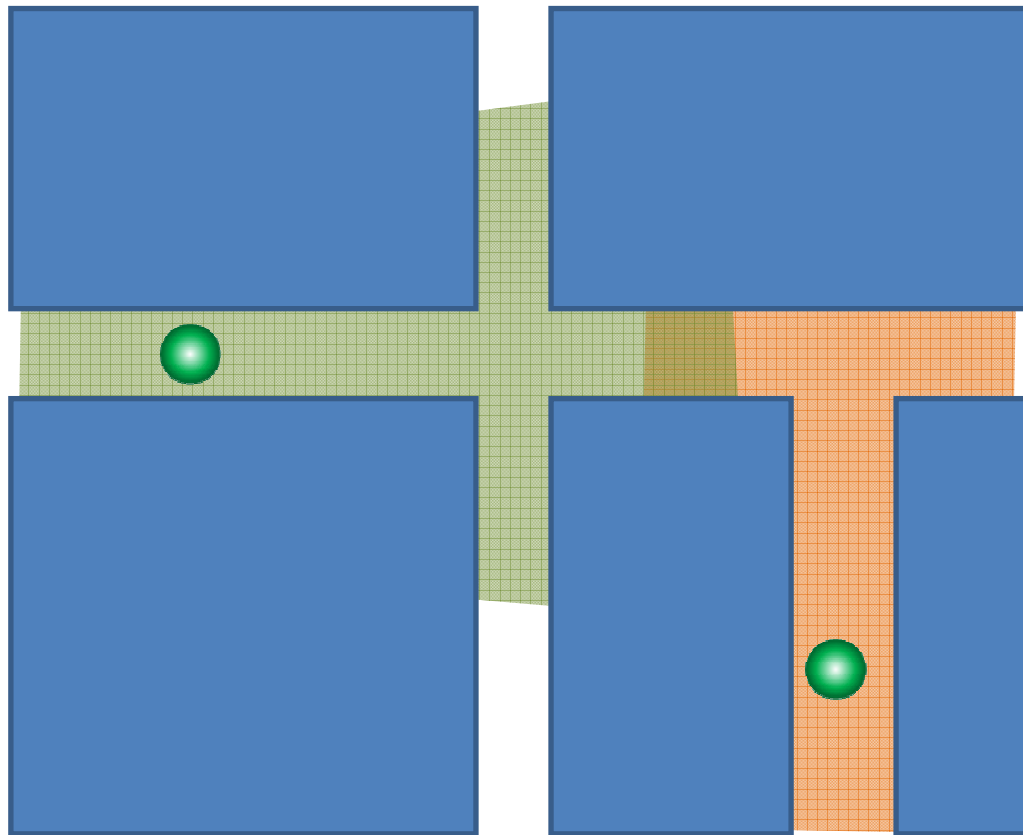
Algorithm details

- Data structure of obstacle map
  - Dividing target region into small grids and represent areas of presence and obstacles be sets of grids
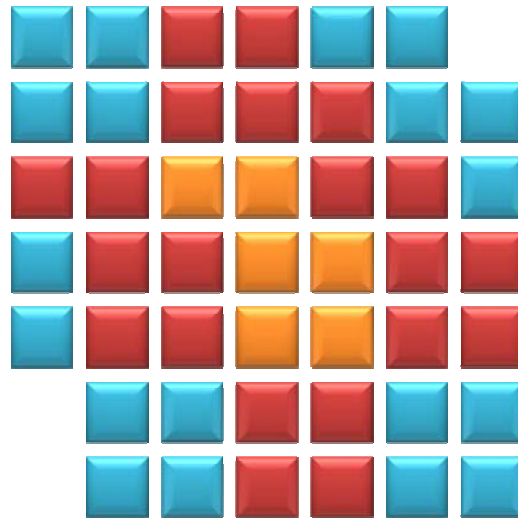
Algorithm details

- UPL Algorithm
  - Computing Area of Presence
  - Expanding Area of Presence by Communication Range
  - Intersecting Two Areas

Algorithm details

- To expand area: APC(Area of Presence Computation) algorithm.

Algorithm details

- UPL Algorithm
  - Computing Area of Presence
  - Expanding Area of Presence by Communication Range
  - Intersecting Two Areas

Algorithm details

- Position estimation

$$\text{select } p \in R \text{ that minimizes } \max_{p' \in R} dist(p, p')$$
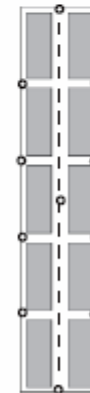
Simulation

- (a) 500m x 500m
- (b) 100m x 500m
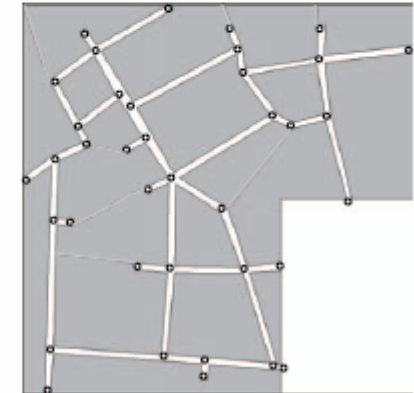- (c) 500m x 500m

SIMULATION PARAMETERS

Grid length (w)	1, **2** or 4 (m)
Radio range (r)	10 (m)
# of nodes	500, 1,000, **2,000** or 3,000
Speed distribution	Normal distribution of [**1.0, 2.0**], [3.0, 4.0], [5.0, 6.0], [7.0, 8.0] or [9.0, 10.0] $(m/sec.)$
Hello message interval	2 $(sec.)$
Initial node deployment	Uniform distribution
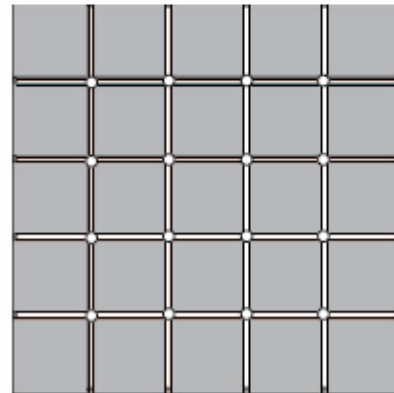
(a) Manhattan (b) Divided Road (c) Osaka Downtown

Simulation

IMPACT OF PARAMETERS AND ENVIRONMENTS ON PERFORMANCE

Parameter/Environment		Accuracy (m^2)	Completeness
Grid length (m)	1	213.3	1.0
	2	216.1	1.0
	4	408.4	1.0
Moving speed ($m/sec.$)	[1.0, 2.0]	216.1	1.0
	[3.0, 4.0]	257.1	1.0
	[5.0, 6.0]	319.1	1.0
	[7.0, 8.0]	397.0	1.0
	[9.0. 10.0]	438.0	0.96
# of nodes	500	435.5	1.0
	1,000	295.7	1.0
	2,000	216.1	1.0
	3,000	188.6	1.0

- Impact of parameters and environments
  - Grid size: 1m, 2m, 4m for grid length
    - Completeness: 1.0
    - Accuracy: smaller gird comes better performance
  - Moving speed
    - Slow speed is better for accuracy and completeness
  - Number of nodes:
    - More node is better

Simulation

- Impact of parameters and environments
  - Effect of ad-hoc localization and Precise Calculation of Movement
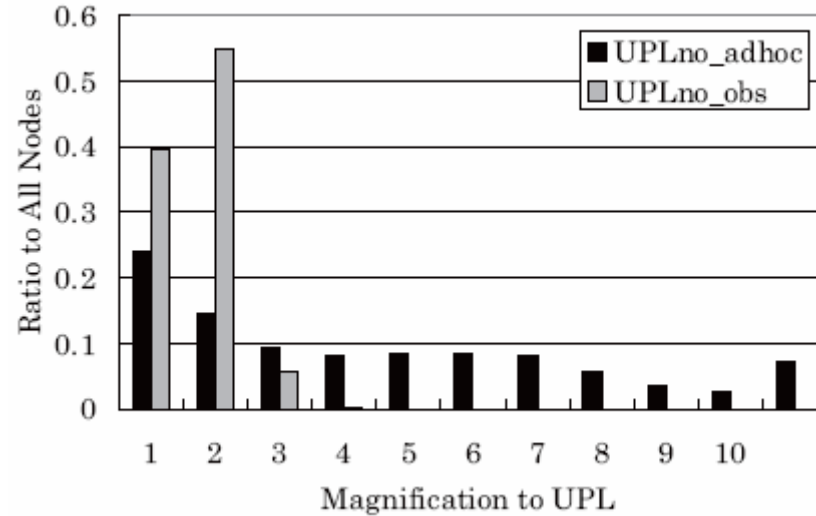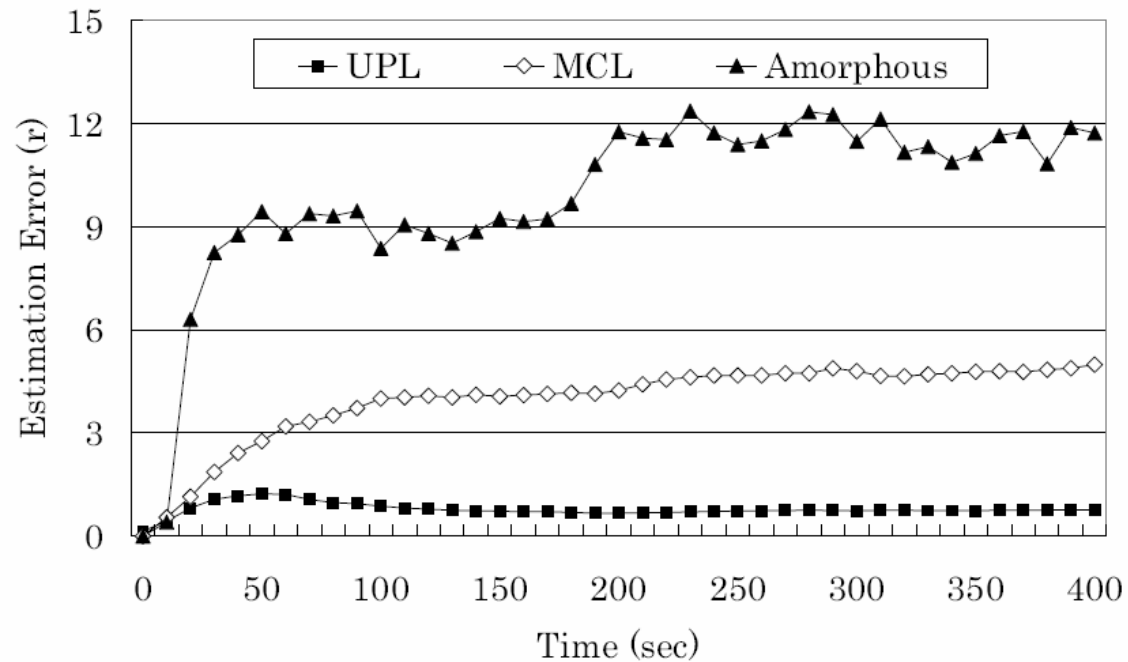
Simulation

- Compare with MCL, Amorphous

Fig. 5.   Estimated Position Errors

Conclusion

- A algorithm performs reasonable accuracy
- Apply obstacle information