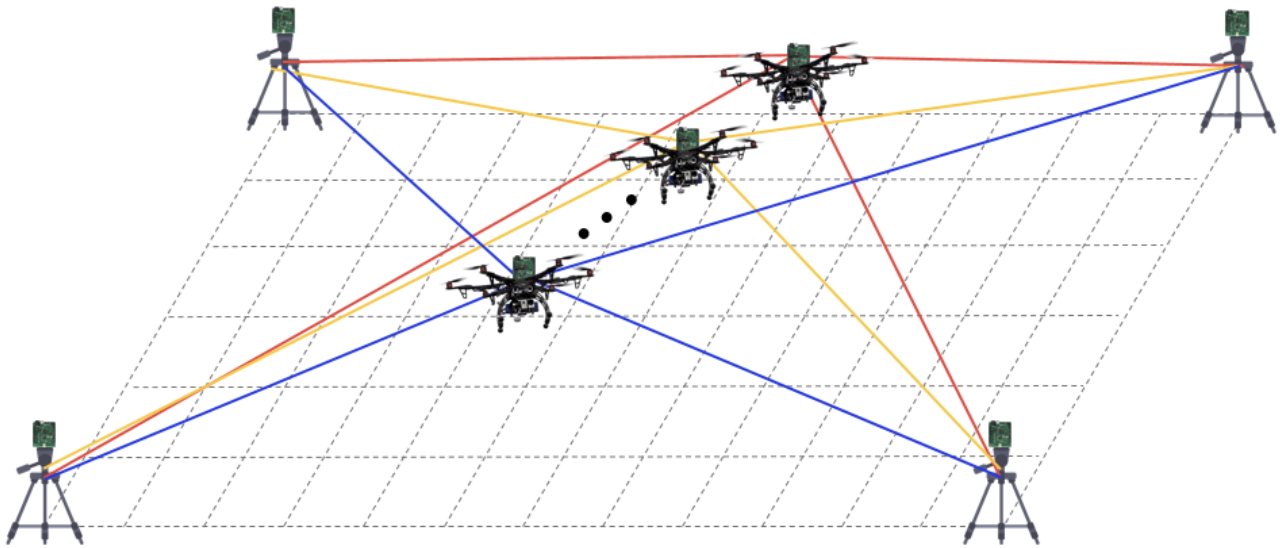
Range-only Net: Recurrent Neural Networks for RO SLAM in Harsh Environment

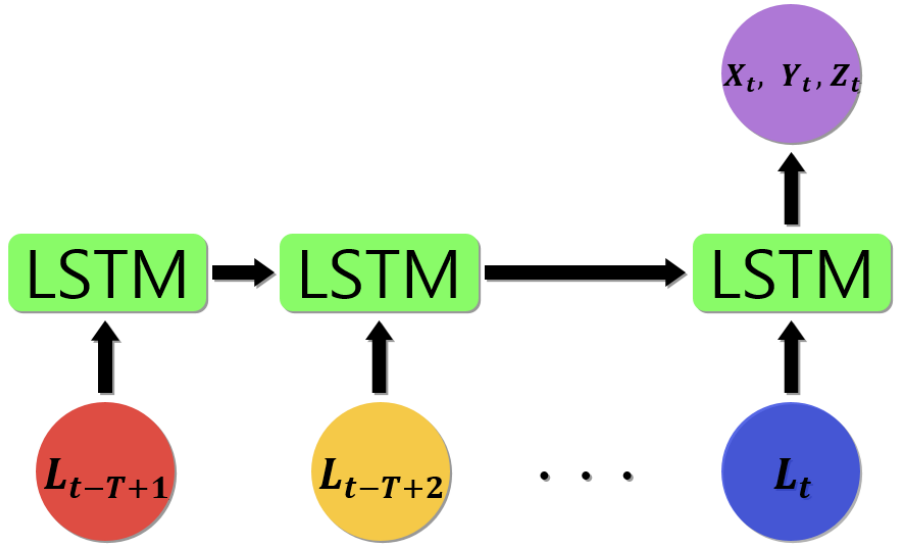
Team3; Hyungtae Lim, Junseok Lee, Yeeun Kim, Changgyu Park

Urban Robotics Lab., KAIST

00 Our Goal

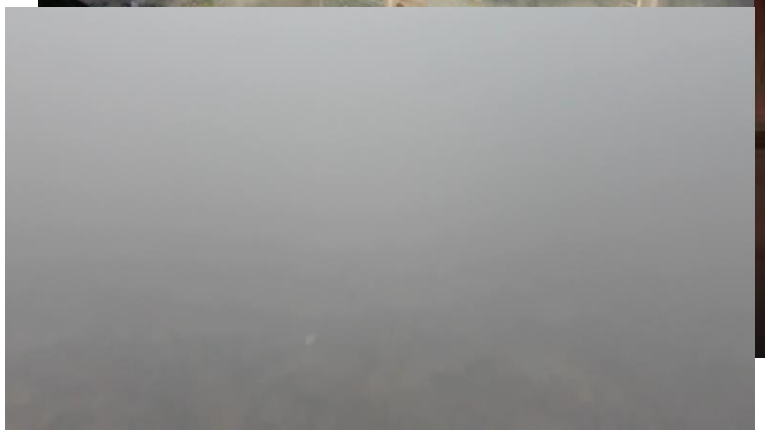
RO Net Overview





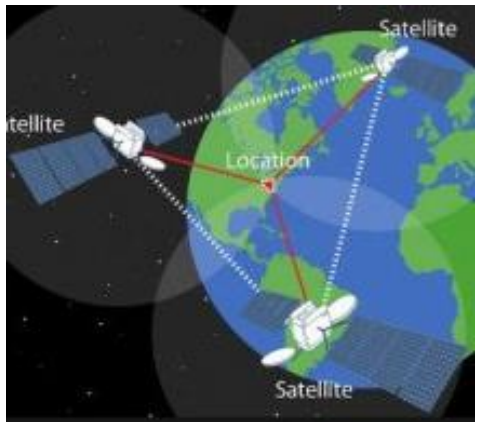
01 Introduction

In disaster situation….



02 Comparison

GPS



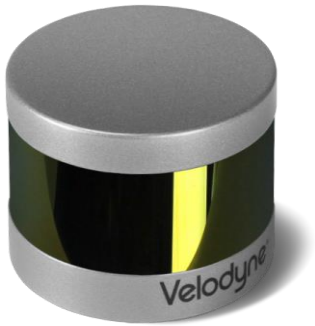
Around $10

Widely used for localization

Error in the order of 10m

Cannot be used indoors

LiDAR



Around $70,000 (Velodyne HD64)

Accurate (<10cm)
Cannot detect transparent material

Light scattering by dust or atmospheric particles

Ultrasonic sensor

Less than $50

Soft surfaces absorb Most of the sound energy

Transmitted and received Beams coaxial

Specular reflection

Vision Camera

$10 - 1000

Huge computational cost

Sensitive to light

Need the features to be detected

Distance Sensor

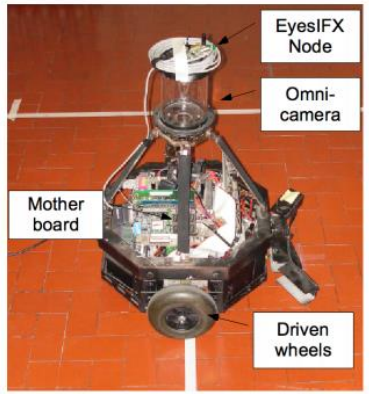
Around $100

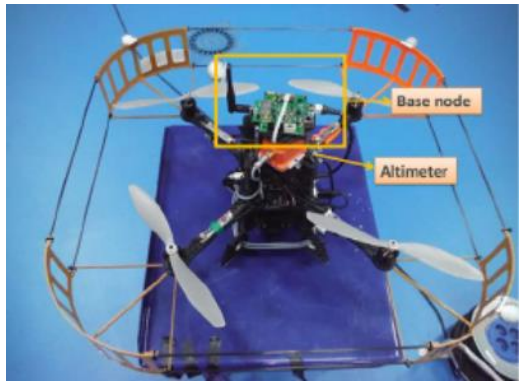
Based on radio technology
Computationally inexpensive

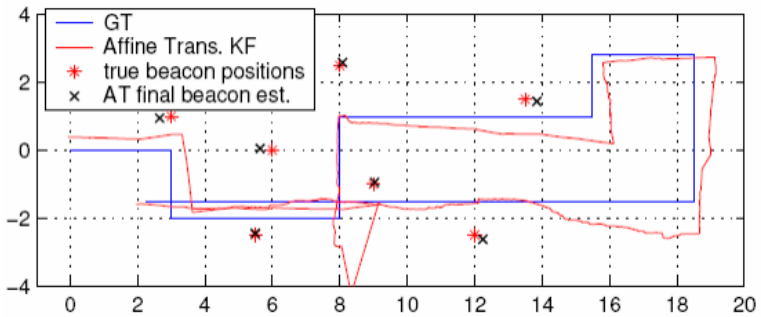
Appropriate under the fog and dust

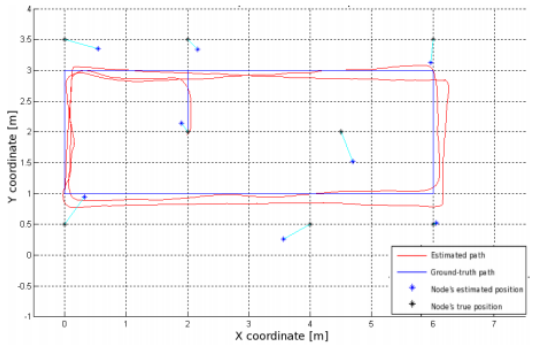
03 Related Works

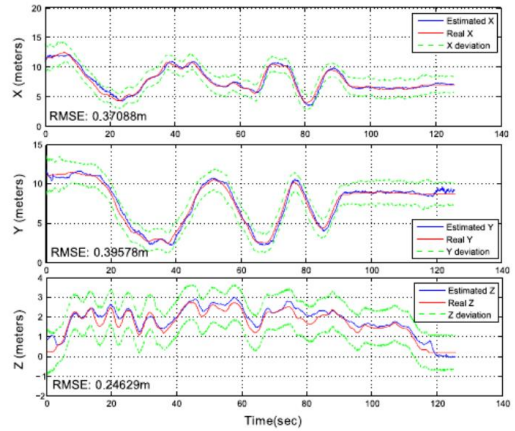
In disaster Situation







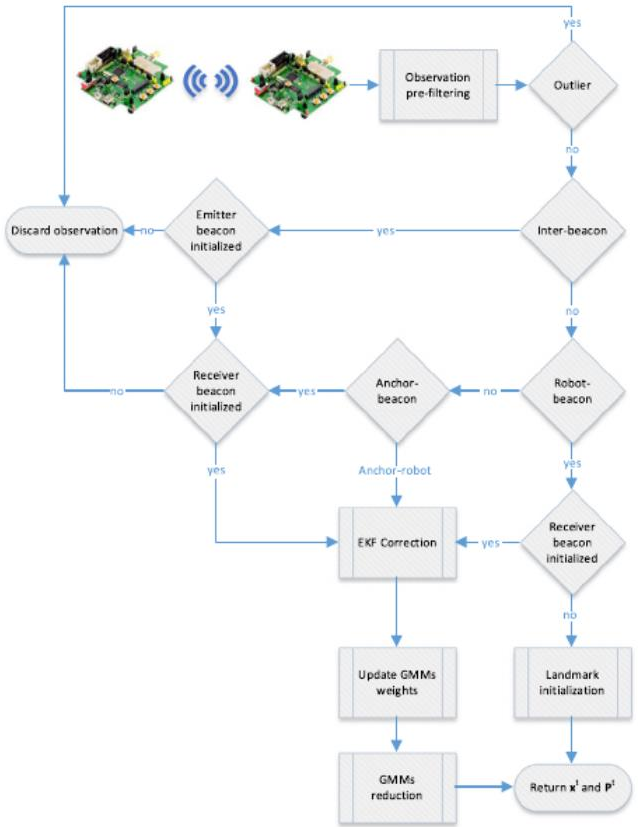




(b)

'Range-only SLAM for Robots Operating Cooperatively with Sensor Networks', In Robotics and Automation, 2006, ICRA 2006
'Range-only SLAM with a Mobile Robot and a Wireless Sensor Networks', In Robotics and Automation, 2009, ICRA'09
An Efficient Approach for Undelayed Range-only SLAM Based on Gaussian Mixtures Expectation , In Robotics and Autonomous Systems, 2018

04 Solution



Probability-based RO SLAM

$\{L_{t-T-1}, \ldots, L_{t-1}, L_t\}$
where $L_t = \{l_1, l_2, \ldots, l_n\}$

LSTM-based Architecture

Position of Robot & Tag

Our deep learning-based end-to-end RO SLAM

05-1
Research Plan

1st (8/27,29)	2nd (9/3,5)	3rd (9/10,12)	4th (9/17,19)	5th (9/24,26)	6th (10/1,3)	7th (10/8,10)	8th (10/15,17)	9th (10/22,24)	10th (10/29,31)	11th (11/5,7)	12th (11/12,14)
Paper study											
	Obtaining and verification of GT data										
						Synchronize b/w distance and GT data					
						Set train/test data					
								Verification			
										Hyper parameter training	

NOW

05-2
Thesis Plan

1st (8/27,29)	2nd (9/3,5)	3rd (9/10,12)	4th (9/17,19)	5th (9/24,26)	6th (10/1,3)	7th (10/8,10)	8th (10/15, 17)	9th (10/22, 24)	10th (10/29, 31)	11th (11/5,7)	12th (11/12, 14)	13th (11/19, 21)	14th (11/26, 28)	15th (12/3,5)	16th (12/10, 12)
Introduction															
NOW		Literature review													
					Methodology										
								Result							
											Review				
														Complete full paper	

06
Team 3

Team Members

Hyungtae Lim

Overall Systems
ROS/Deep Learning

Junseok Lee

Sensors /
Hardware Platform

Yeeun Kim

Deep Learning
Architecture

Changgyu Park

Data Preprocessing /
Data acquisition