ICCAS 2022 Poster

Parsing Indoor Manhattan Scenes Using Four-Point LiDAR on a Micro UAV

Eunju Jeong, Suyoung Kang, Daekyeong Lee, and Pyojin Kim
Department of Mechanical Systems Engineering, Sookmyung Women's University

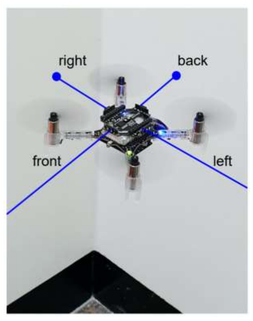
SOOKMYUNG WOMEN'S UNIVERSITY

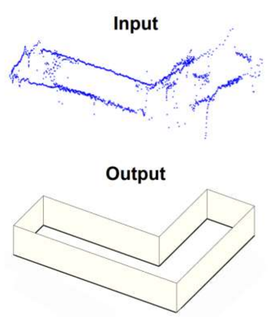
MPIL Machine Perception and Intelligence Lab

Motivation

- Various advantages of using **micro UAVs** for **indoor mapping and SLAM**
- 2D laser scanner and RGB-D camera are **not available** for micro UAVs because of the **small payloads**

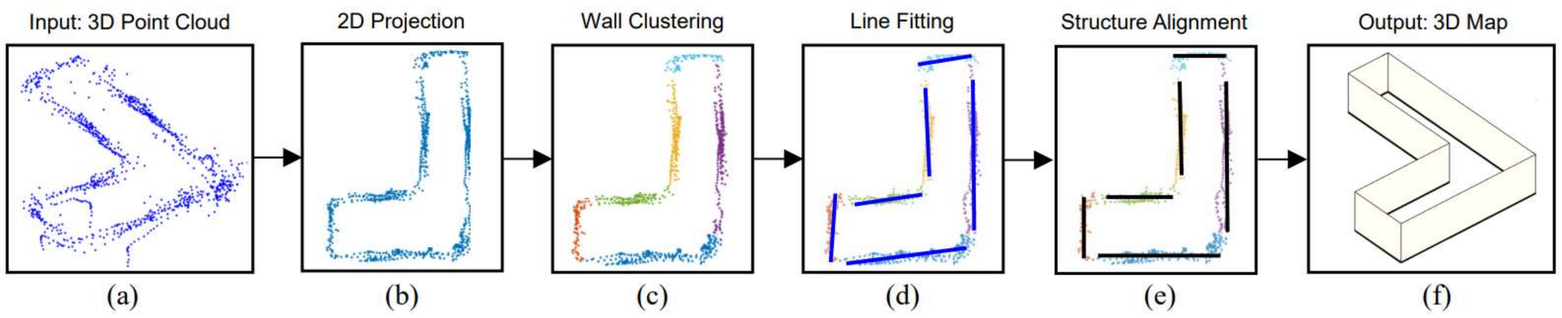
Contributions

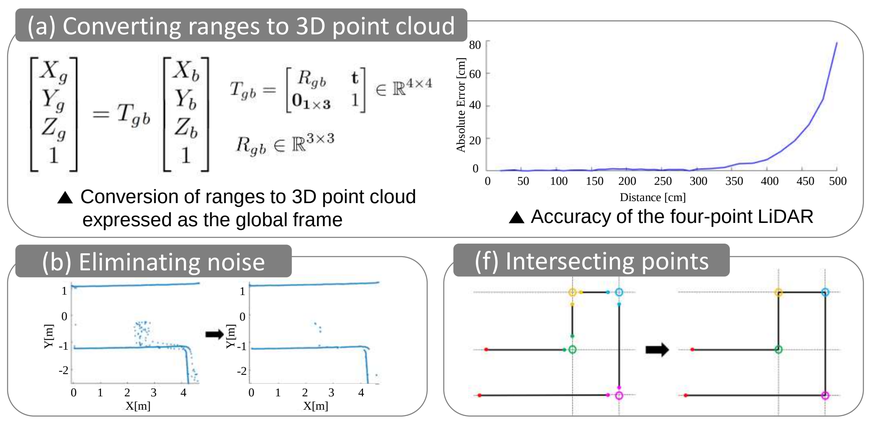




- Using **structural regularities** in the Manhattan World, the proposed method with a **lightweight and inexpensive** four-point LiDAR demonstrates **comparable performance** to an expensive 3D LiDAR

Pipeline of the proposed method

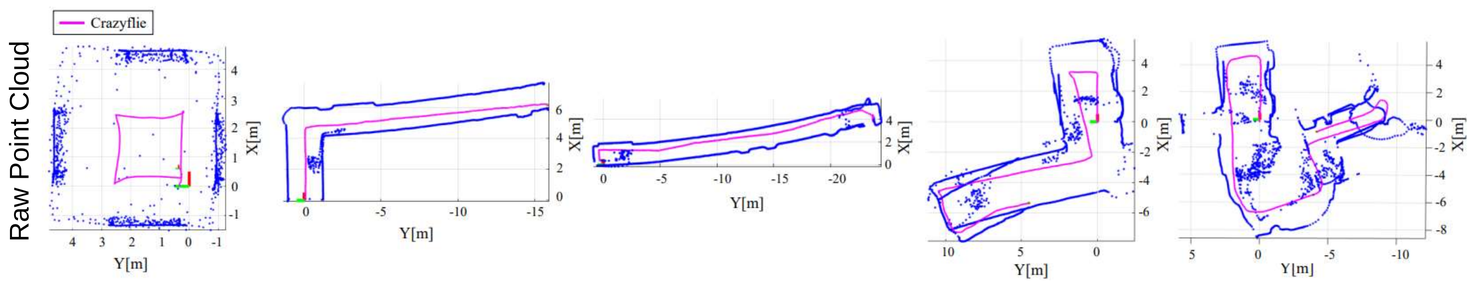




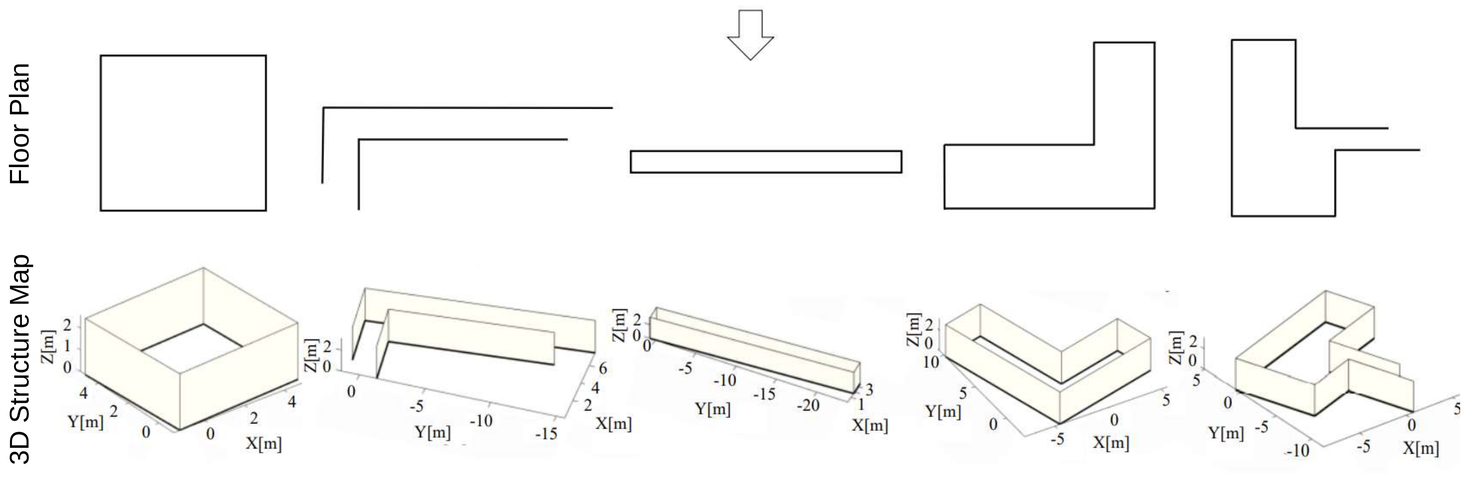
- Conversion of range measurement to **3D point cloud** (a), 2D projection and **eliminating the noise** of point cloud (b), **wall clustering** with Hierarchical clustering (c), **line fitting** of each cluster with line model estimated by RANSAC (d), alignment of lines with respect to the **Manhattan structures** (e), building a **3D structure map** by projecting the floor plan as measured ceiling height on the z-axis (f)

Evaluation

- Evaluation on **various Manhattan world indoor environments** from room scale to building scale

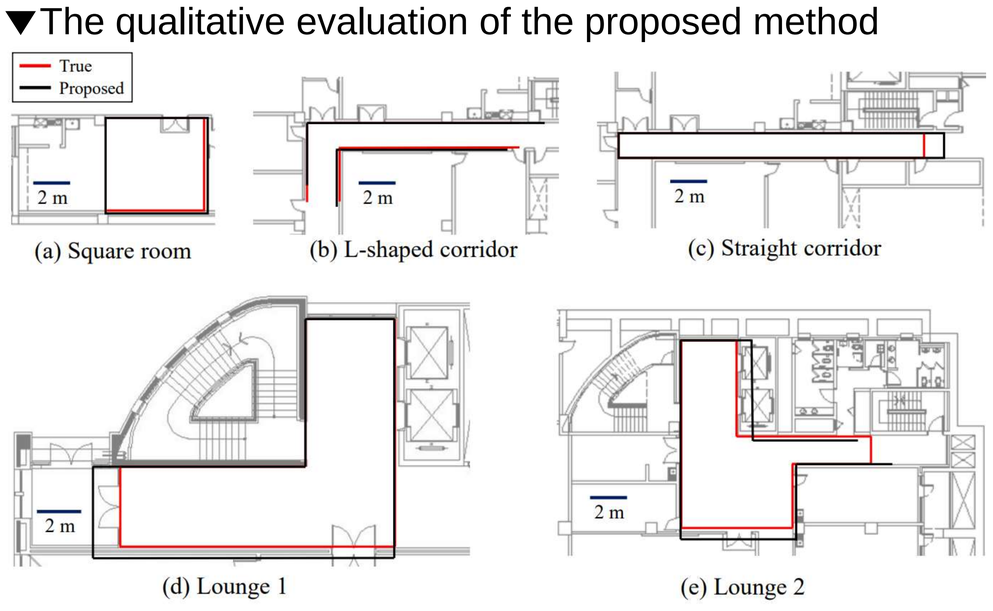


▲ Noisy and distorted raw point cloud due to **the inaccurate 6-DoF pose estimation of micro UAV** and **the range measurement limitation of low-cost ToF sensors**



(a) Square room (b) L-shaped corridor (c) Straight corridor (d) Lounge 1 (e) Lounge 2

▼The qualitative evaluation of the proposed method



▼ The quantitative evaluation of the proposed method

	Length Error (m)	Flight Time of Crazyflie
Square room	0.232	46 sec
L-shaped corridor	0.17	1 min 46 sec
Straight corridor	0.744	1 min 30 sec
Lounge 1	0.587	1 min 18 sec
Lounge 2	0.551	2 min 14 sec