Featureless Corridor: 2D vs 3D LiDAR

2D vs 3D LiDAR in a Featureless Corridor

w/ 2D LiDAR

How to apply

- **Map-based localization.** Align scans to a 2D occupancy/contour map with **ICP** or **NDT**. Seed with wheel odom.
- **SLAM when no map.** 2D scan matching + **loop closure** to cap drift. Keep grid small; reject outliers.

Examples

- **SICK NAV3xx** on AGV/AMR. Uses natural contour localization [1].
- **Hokuyo UST-10LX** on many AMRs.

Challenges

- **Geometric degeneracy.** Long plain walls ⇒ ambiguous matches ⇒ drift. Mitigate with loop closure and IMU/odom fusion [2].
- **Dynamic scenes.** People/carts hurt scan matching. Use dynamic masking or tracking [3].

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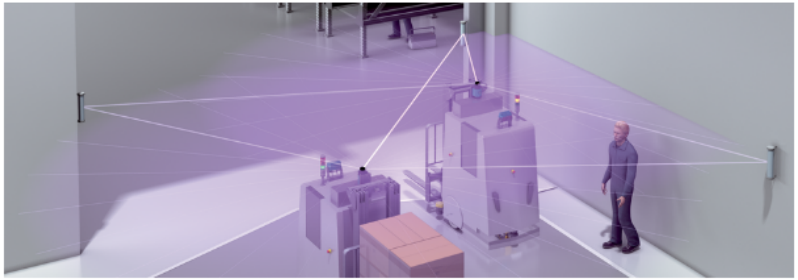

NAV3xx

The sensors in the NAV3xx product family are the right choice for localizing larger automated guided vehicle (AGV) systems. Thanks to the large scanning range of up to 250 m, the sensors can detect contours or reflectors even in wide and open areas or long corridors.

https://www.sick.com/media/familyoverview/6/16/916/familyOverview_NAV3xx_g91916_en.pdf

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UST-10LX

The UST-10LX is a compact, lightweight 2D LiDAR sensor used for obstacle detection and localization on autonomous mobile robots (AMR) and automated guided vehicles and carts (AGV, AGC). Equipped with an Ethernet interface, it can obtain high-speed, accurate measurement data in a 270° field-of-view up to 10 meters. Due to its low power consumption, this scanner is suitable for battery-operated platforms.

https://www.hokuyo-usa.com/products/lidar-obstacle-detection/ust-10lx

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- Run **3D LiDAR SLAM** with **IMU fusion** (LOAM/FAST-LIO-style).
- Add **loop closure** for stability.

Examples

- **Balyo robotic forklifts** use **Ouster** 3D digital LiDAR [3].

Challenges

- **Geometric degeneracy** in long, planar corridors ⇒ drift. [4], [5].
- **Motion distortion & time sync.** [4].
- **Perceptual aliasing** for loop closure. [4].
- **Registration robustness** under planar walls. [5], [6].
- Higher compute and cost than 2D.

2D vs 3D LiDAR in a Featureless Corridor

https://www.businesswire.com/news/home/20210517005834/en/Balyo-Selects-Ousters-Digital-Lidar-for-Its-Robotic-Forklifts

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Reference

[1] *NAV3xx: High performance 2D LiDAR sensor for navigation of AGVs/AMRs (product family overview)*. SICK AG, 2025. Available: https://www.sick.com/media/familyoverview/6/16/916/familyOverview_NAV3xx_g91916_en.pdf

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[3] “Balyo selects ouster’s digital lidar for its robotic forklifts.” Business Wire / Ouster, Inc. Press release, May 17, 2021. Available: https://www.businesswire.com/news/home/20210517005834/en/Balyo-Selects-Ousters-Digital-Lidar-for-Its-Robotic-Forklifts

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