Visualization of the mobile robot manipulator for the DARKO project

Background

The EU-project **Dynamic Agile** Production **Robots** that learn and optimize **Knowledge** and **Operations** (DARKO) represents a groundbreaking endeavor that combines state-of-the-art robotic components from Robotnik [1] and Franka Emika [2], leveraging their expertise in mobile robot bases and robotic arms, respectively. This project seeks to push the boundaries of mobile robotic manipulation through the integration of advanced perception and mapping technologies.

In this context, the integration of the **Azure Kinect Camera** SDK [3] holds immense potential. The Azure Kinect Camera offers a powerful tool for capturing high-resolution RGB and depth data, enabling precise environmental perception. Furthermore, the use of **LIDAR** [4] technology complements this by providing accurate and real-time mapping capabilities essential for Simultaneous Localization and Mapping (**SLAM**) [5]. The successful execution of these objectives would not only advance the capabilities of the DARKO mobile robot manipulator but also have far-reaching implications for industries such as logistics, manufacturing, and healthcare, where mobile manipulation in complex and changing environments is crucial.

Your Tasks

In this thesis, your task will be learning state-of-the-art knowledge of robot operation system and object detection. Further step will be utilizing LIDAR technology for SLAM, to be specific:

1. You will first learn basic knowledge of robot operation system (rosnode/rostopic/rosmsgs etc.).

2. You will reproduce the results from KI-Fabrik repositories and other related research topics. By doing this, you will have a deep understanding of object/motion detection via computer vision tech etc.

3. You will enable autonomous marking surrounding objects and mapping in dynamic and unstructured environments.

Requirement

- High self-motivation;
- Approx. six-month working time;
- Experiences or knowledge from related courses;
- C++ programming experiences.

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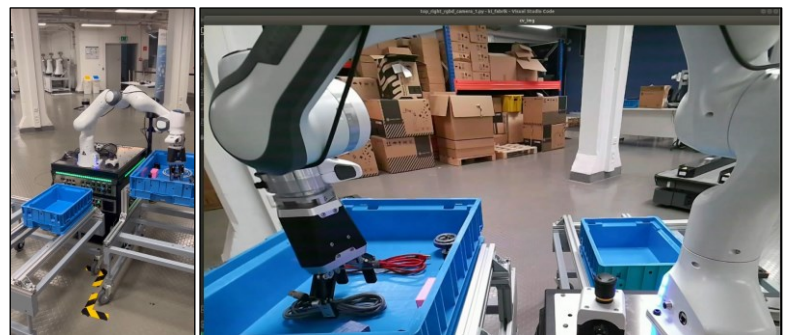
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Figure 1 Overview of the DARKO develop environments.

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[1] Robotnik. Mobile Manipulators. [Online]. Available at: https://www.robotnik.eu/mobile-manipulators/
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[3] Microsoft Azure Kinect Documentation. (n.d.) [Online]. Available at: https://docs.microsoft.com/en-us/azure/kinect-dk
[4] Placed, J. A., Strader, J., Carrillo, H., Atanasov, N., Indelman, V., Carlone, L., &Castellanos, J. A. (2023). A survey on active simultaneous localization and mapping: State of the art and new frontiers. IEEE Transactions on Robotics (T-RO).): 93-146.
[5] Roriz, R., Cabral, J. and Gomes, T., 2021. Automotive LiDAR technology: A survey. IEEE Transactions on Intelligent Transportation Systems, 23(7), pp.6282-6297.