ONLINE SELF-ADAPTIVE BEHAVIOR OF MOBILE ROBOTS THROUGH SKILL KNOWLEDGE GRAPHS

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TD6 Reasoning and Acting Technologies

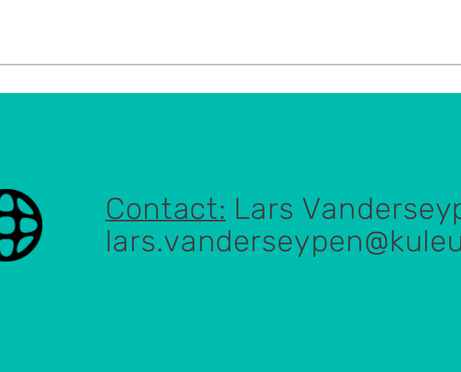
GOAL

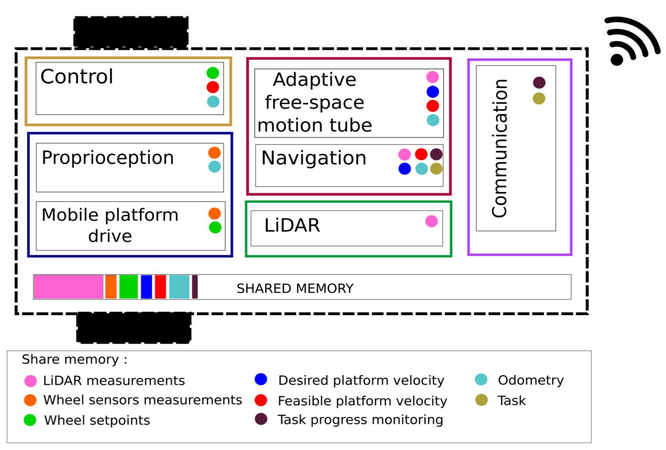
This work aims at enabling mobile robots to **autonomously adapt** their **behavior** based on their current traffic **situation**.

The relationships between different traffic situations and the robot's skills are formalized in **knowledge graphs**.

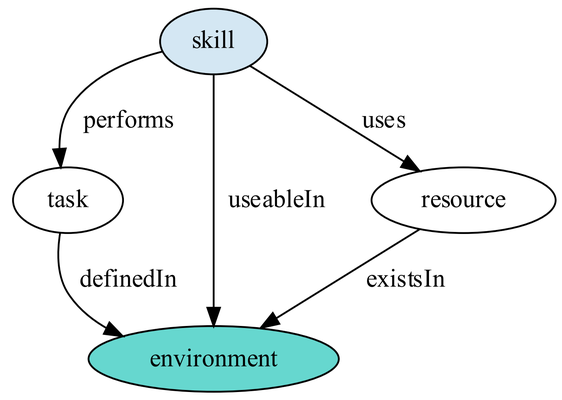
MOTIVATION

- Mobile robots navigating in **shared** and **dynamic environments** encounter various traffic situations.
- **Changing** traffic situations can require robots to **adapt** their **behavior** to ensure task completion.
- Robot behavior is implemented through **skills**, where the skill software needs to be **configured**.
- Configurations are often chosen at **deployment time**, the presented work allows the robot to autonomously switch configurations at **runtime**.



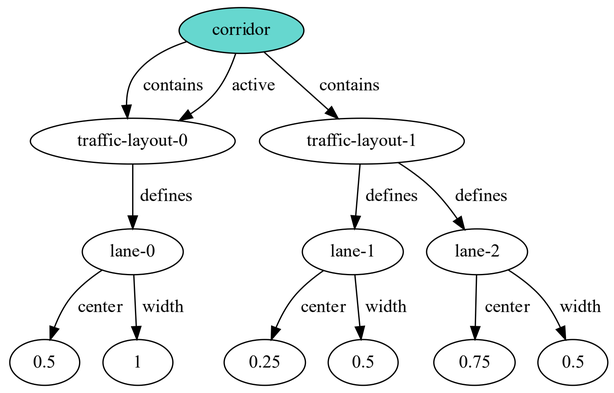


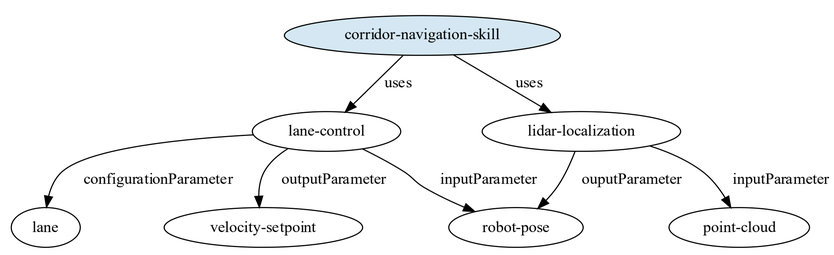
APPROACH



Skill knowledge graph

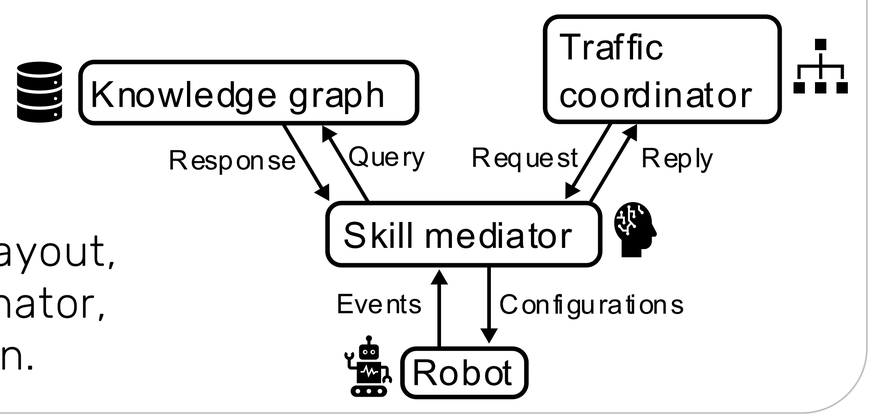
- Makes **dependencies** between skill software configurations and tasks, environments, and resources explicit.
- Each node represents a **subgraph:**





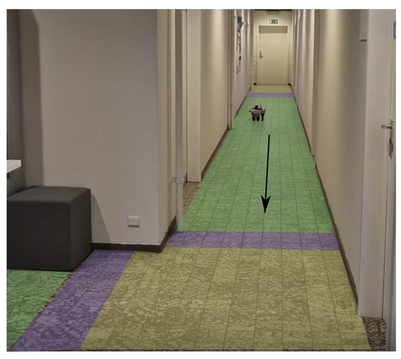
Skill mediator

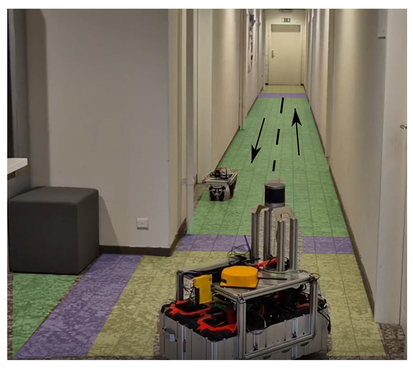
- **Queries** knowledge base for valid skill configurations.
- Responds to changes in traffic layout, communicated by traffic coordinator, by finding **new** skill configuration.

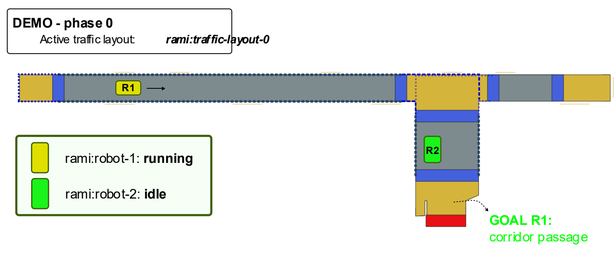


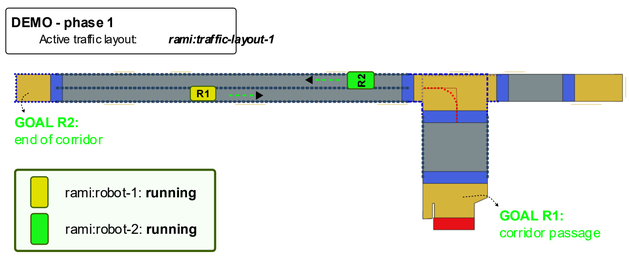
RESULTS

- Validation in a **multi-robot navigation case**.
- Traffic layout is **changed** at runtime from **one-lane** to **two-lane layout**.
- Robot autonomously adapts **corridor navigation skill** to new lane layout.









KEY TAKE-AWAYS

- Skill **knowledge graph** represents connection between traffic situations and skill software configurations.
- Skill **mediator** queries knowledge graph at runtime to find valid configurations and reconfigures robot software accordingly.

FURTHER READING

- Traffic coordinator: poster 212
- Vanderseypen, L., Van Baelen, S., Artigas, M.I., Tsiogkas, N., Bruyninckx, H. (2025). Online self-adaptive behavior of mobile robots through skill knowledge graphs. Workshop on Ontologies for Autonomous Robotics at RoboticCC, Naples, 08 Dec 2025-10 Dec 2025.

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For Publication