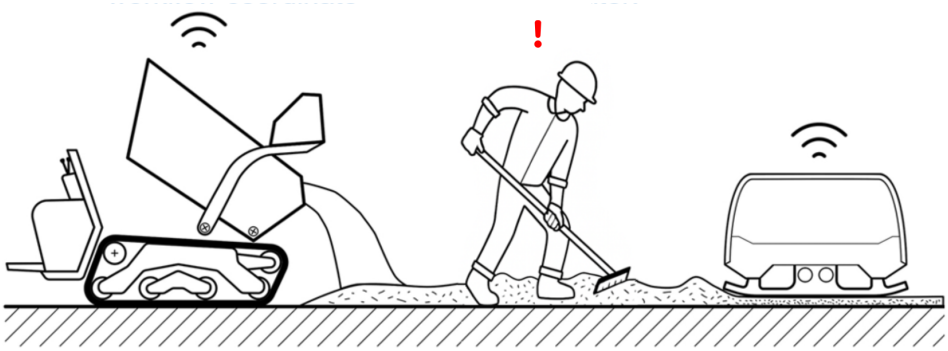
Multi-Agent Mission Planning for Construction Tasks using PDDL

Background

Construction sites are highly dynamic environments where numerous heterogeneous agents (e.g., excavators, AMRs, human crews) must cooperate to accomplish complex, interdependent tasks under strict time and safety constraints. Reliable task planning and scheduling requires determinism, which is a strength of AI planners using carefully designed Problem Domain Definition Language (PDDL) descriptions.

In our Collaborative Construction Robots (CoCoRo) project, we are developing a use case in which three autonomous construction vehicles work together with a human on a common task. An autonomous dumper loads, unloads, and transports bulk material, a human worker grades the material, a compactor plate consolidates it, and a mobile server coordinates and overlooks the process.

To coordinate the available robots, a high-level planner is needed that exchanges information with a digital construction twin and produces save and regulation compliant task schedules to be carried out. If a task fails or a condition changes, a new plan satisfying the goal constraints should automatically be generated.



Tasks and Objectives

The scope depends on the type of thesis. Possible objectives include:

- Defining modular regulation compliant domains for the bulk load material transport and compaction use case
- Literature research to find appropriate planners
- Extending plansys2 or developing a plan execution infrastructure
- Simulating a digital construction twin that provides the symbolic state of the construction site
- Creating a comprehensive ontology for standardizing construction robot types, skills, and relations

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Research project:
CoCoRo

Type:
Bachelor / Semester Thesis / Master Thesis

Research area:
Multi-agent planning, Systems Engineering

Programming language:

Required skills:
Familiar with PDDL or First Order Logic, Self Motivated

Language:
English / German

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