NRI: FND: Knowledge-based Robot Sequential Decision Making under Uncertainty (NRI #1925044)

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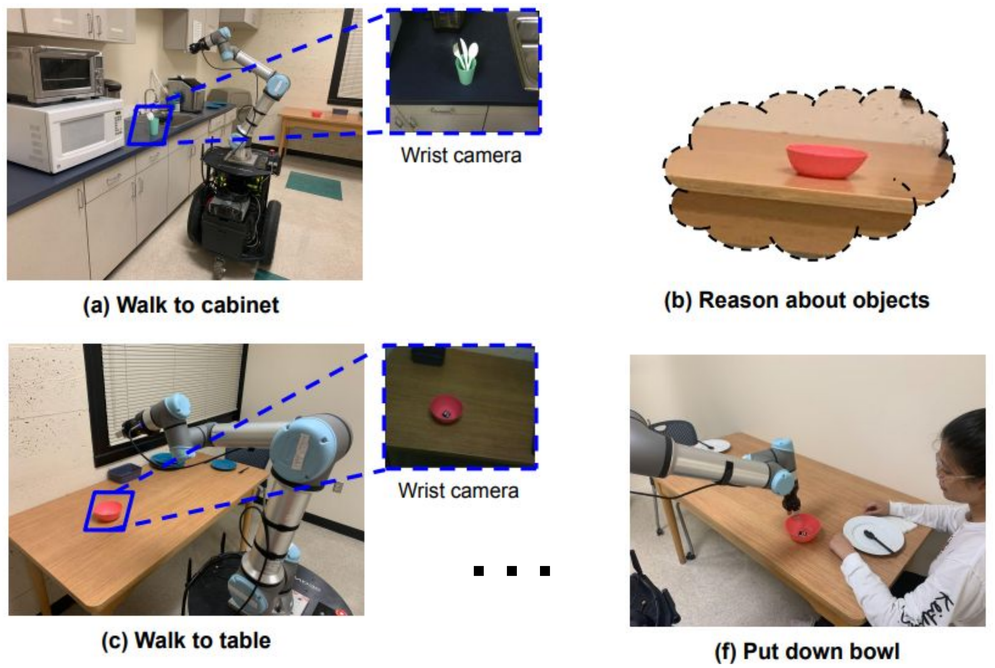
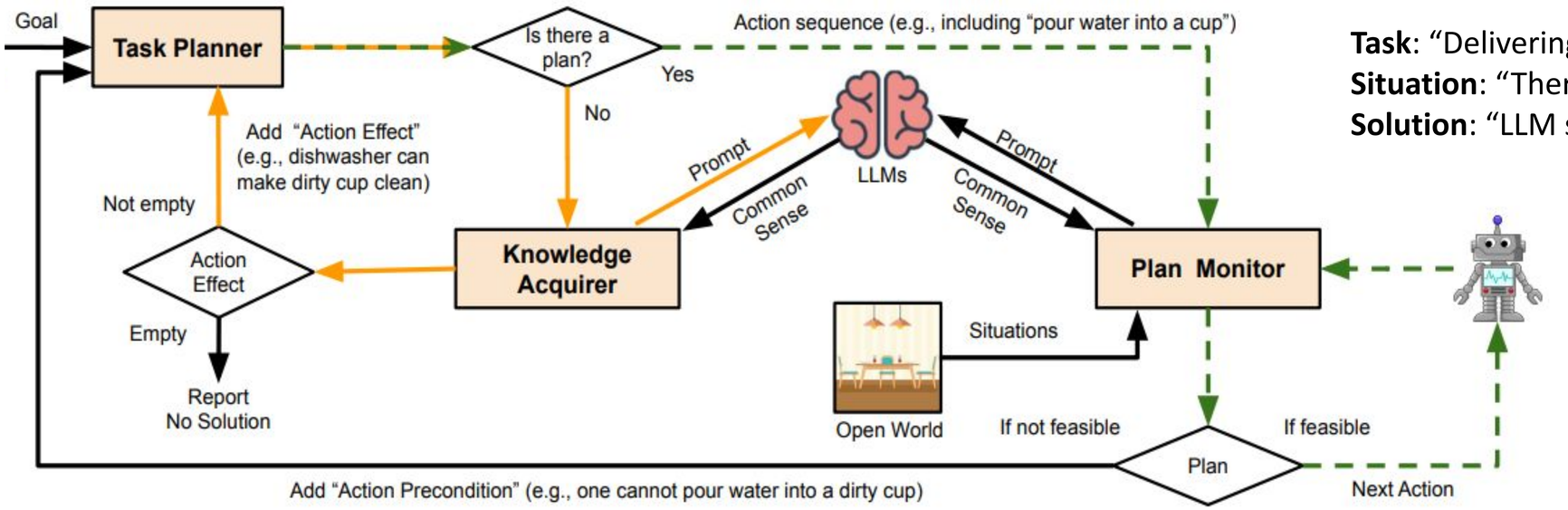
Background: Reasoning with declarative knowledge and sequential decision-making are two key areas in AI and Robotics. Both classes of methods reason in the presence of uncertainty. Despite the rich literature in these two areas, researchers have not fully explored their complementary strengths.

- **Challenge:** How to leverage declarative knowledge in sequential decision-making methods (e.g. model-based, data-driven), given the different computational paradigms?
- **Approach:** 1) Unified representation for reasoning and planning under uncertainty, and 2) Reasoning for state estimation to guide planning and reinforcement learning
- **Scientific Impact:** Bridging the representation gap between knowledge-based reasoning methods, and data-driven sequential decision-making methods





Common sense-based Open-World Planning (COWP)

Task: "Delivering a cup for drinking water."
Situation: "There were objects in the cup (a knife, a fork, etc)."
Solution: "LLM suggested a bowl could be used for drinking water."

Contribution: Novel algorithm and system, called COWP, for open-world task planning and situation handling that dynamically query LLMs for augmenting the robot's action knowledge with common sense

Robot Task Planning and Situation Handling in Open Worlds, Ding, X Zhang, Amiri, Cao, Yang, Esselink, and S Zhang, arXiv 2022

2023 NRI & FRR Principal Investigators' Meeting
May 2-3, 2023

Award ID#: 1925044