

CogRob Report

Your Name

Abstract—Write your abstract here.

Index Terms—Write up to three keywords about your work.

I. Introduction

This is a template for MAS R&D projects, based on IEEETran. Here are some preliminaries about some common things you need to do to use the template:

- Add your references to the file references.bib and cite them as Mustermann and Smith [1] (if there are more than three authors, cite as Mustermann et al. [1]).
- Refer to sections as Sec. I.
- You can include figures as follows (note that the figure caption is below the figure). Refer to figures as Fig.



Fig. 1: My caption

- 1.
- You can add tables as follows (note that the table caption is above the table). Refer to tables as Tab. I.

TABLE I: My caption

Header 1	Header 2
Cell 1	Cell 2
Cell 3	Cell 4

- You can add equations as follows.

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2} \quad (1)$$

Refer to equations as Eq. 1.

A. Motivation

Describe the context of your work and the motivation for it.

B. Problem Statement

Describe the problem you are addressing in the work.

*Submitted to the Department of Computer Science at Hochschule Bonn-Rhein-Sieg in partial fulfilment of the requirements for the degree of Master of Science in Autonomous Systems

[†]Supervised by Supervisor 1 (Affiliation) and Supervisor 2 (Affiliation)

[‡]Submitted in Month 20XX

C. Proposed Approach

Write a short summary of your proposed approach.

II. Related Work

Summarise the relevant related work in this section and position your work with respect to the related work.

III. Background

This is an optional section in which you can introduce concepts, terms, or methods that are important for understanding your approach and that would not directly fit in Sec. IV. If you do not need this section, comment out the respective line in report.tex.

IV. Methodology

A. Simulation

The agent and it's environment are simulated in the physics simulator PyBullet. The agents body is a mobile manipulator consisting of a square base with omnidirectional movement and an 7 Degrees-of-Freedom robot arm, a modified version of the Kuka (?????) robot arm. The modifications consist of disabling limitations in is rotation, so the arm can reach all around its base. Furthermore, the arm does not have a fully simulated gripper, instead grabbing and placing is simplified to attaching object to the arm and teleporting them to desired locations when the arm is in close proximity.

PICTURE OF THE AGENT

The environment consists of a simple two room household, one kitchen and one livingroom. The kitchen contains a three layered shelf as well as a table which are capable of holding items. The living room contains a TV on a table. Both rooms are connected via a hallway.

PICTURE OF THE ROOMS

To allow the agent to interact with the environment and the items in it, it has multiple tools it can call. All of these tool calls are done via the LLMs tool calling and return status messages in text form. The implemented tools are as follows:

- Percieve The agent percieves its surroundings and the tool call returns in which location it is on an semantic map of the environment as well as what objects are in said location (check more closely).
- Move To The agent can pick a goal location on the semantic map, like in front of the shelf, and first a valid path in the semantic map is searched via the A* algorithm and if a valid path is found the agent will move along the path to the goal and the tool call

returns that the goal has been reached. If no valid path is found, this tool returns a failure.

- **Grab** The agent specifies an item it wants to grab and this tool will move the robot arm towards the specified item's location. If the end-effector of the arm comes close enough to the item it will be attached to it and the tool call will return a successful grab. This tool call can fail if the item to be grabbed does not exist, if the robot is already holding an item, or if the item is out of reach of the robot. All these failures return the fail condition as well.
- **Place** This tool call allows the agent to place the item it is currently holding in a specified place location, for example the middle (plane??) of the shelf. A successful place will occur if the agent is holding an item, the place location is empty (no other item is present), and the end-effector of the arm comes close enough to the place location. If any of these conditions are not met the tool call returns a failure specifying which condition was violated.

V. Evaluation

If your work involved experiments, describe the experimental setup and the results in this section.

VI. Conclusions

- A. Summary
- B. Contributions
- C. Future Work

References

- [1] M. Mustermann and J. Smith, "Some Title," in Some Conference, 2023, pp. 1–8.

ACKNOWLEDGMENT

Write your acknowledgments here.

STATEMENT OF ORIGINALITY

[If AI assistants have not been used, use this sentence] I, the undersigned below, declare that this work has not previously been submitted to this or any other university and that it is, unless otherwise stated, entirely my own work.

[If an AI assistant has been used, use this sentence] I, the undersigned below, declare that this work has not previously been submitted to this or any other university and that it is, unless otherwise stated, entirely my own work. The report was, in part, written with the help of the AI assistant [AI assistant name] as described in the appendix. I am aware that content generated by AI systems is no substitute for careful scientific work, which is why all AI-generated content has been critically reviewed by me, and I take full responsibility for it.

Appendix

Please limit the main part of the report to 20 pages (not including the references, the statement of originality, and the appendix).

In your appendix, you can add any additional details about your work, such as:

- extra results that do not necessarily belong in Sec. V
- more detailed justifications of certain algorithm design decisions
- algorithm proofs

Additionally, in the case of using AI assistants, describe in detail what content was generated using an AI assistant. In particular, name the AI assistant(s) that you used and how they were used (e.g. which prompts were used, and for which parts of the project).

Date

Signature